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THE MARINE OBSERVER

A QUARTERLY JOURNAL OF MARITIME METEOROLOGY PREPARED BY THE MARINE DIVISION OF THE METEOROLOGICAL OFFICE

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COVER PHOTOGRAPH: Eagle Owl photographed from m.v. *Wiltshire* by Mr I.G. MacNeil on 16 October 1991, in the Arabian Sea whilst on passage from Al Jubail to Mangalore.

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Annual Report of the Observations (Marine) Branch for 1993

1. Voluntary Observing Fleet (VOF)

As of 31 December 1993 the United Kingdom VOF was made up as follows:

(a) 477 Selected Ships. These ships make full voluntary observations of the weather at sea at specified times; they are equipped with special sets of meteorological instruments and stationery loaned for this purpose.

(b) 2 Supplementary Ships. They carry out an observing programme at a slightly lower level than Selected Ships, using an abridged complement of instruments.

(c) 36 'MARID' vessels. These are mainly ships engaged in the North Sea and coastal trades, providing useful data on sea temperature and current weather; their returns are of much assistance in the forecasting of fog in the areas in which they trade. In certain cases the data may also provide forewarning of the formation of sea-ice.

(d) 1 automatic light vessel (*Channel*) and 1 light tower, (Royal Sovereign). *Smith's Knoll* light vessel was called in for maintenance by Trinity House in September and operation of the automatic weather station was therefore suspended.

(e) 8 Auxiliary Ships. These are ships recruited on a voyage-by-voyage basis, to make and transmit limited observations using a special form provided by Port Met. Officers. These ships are particularly helpful in sending in vital weather information from normally data-sparse oceanic areas.

(f) 34 Oil Rigs and Platforms. They report in Ship Code from the oil fields around the North Sea and continental shelf. Offshore Advisers at Aberdeen Weather Centre and Bracknell HQ liaise in this section of marine observing work.

The instruments supplied to Selected Ships are precision aneroid barometer, marine barograph, two each of dry- and wet-bulb thermometers in Stevenson screens, sea temperature thermometer and bucket, logs, code books and other stationery. Some ships are also fitted with special distant reading or automatic weather message transmission terminals supplied by the Met. Office.

These ships are part of the World Meteorological Organization (WMO) scheme involving about 7,400 merchant ships world-wide.

Our seven Port Met. Officers based at main United Kingdom ports continued in their efforts to persuade further merchant ships to be recruited to the Voluntary Observing Fleet.

The records contained in the 924 ships' meteorological logbooks received during the year continue to be entered into the Marine Data Bank, ensuring their usefulness to climatologists. Due to the increasing use of satellite navigation systems, ocean current entries in the log pages provided for the purpose have decreased markedly, but current records entered as instructed are still required. Reports, photographs and sketches of all kinds of phenomena continue to come in from voluntary observing ships, and copies of these are forwarded to scientists and other experts for their use and analysis. Often the information received from ships is found to be of original value to the scientific community, who stress that anything might be useful, no matter how common it may seem to the shipboard observer.

In December the offshore industry was treated to an introduction of the latest cost-reducing and lifesaving forecasting techniques at Aberdeen. Invited industry guests were advised about new computer models for specific oil location work, the latest enhanced wave and wind forecast techniques, and state-of-the-art electronic information chains, to enable them to cut down-time and improve safety.

The Met. Office atmospheric model moves global weather ahead in 10-minute steps to six days ahead, for 1,249,920 grid points, and therefore provides considerable detail on developments. To enable higher levels of detail, a limited-area model covering the British Isles and North Sea moves the weather ahead in five-minute steps, providing output to 36 hours ahead for 604,560 grid points. The Met. Office uses these atmospheric models to produce two separate wave models: one covering the entire globe and a European wave model, incorporating higher-resolution winds and shallow-water physics, which provides more detail for operators on the Continental Shelf.

The Met. Office Observing System for Ships (MOSS), Distant Reading Equipment and Automated Shipboard Aerological Programme (ASAP) equipment, where fitted, have continued to give reasonable returns, with one or two exceptions, notably in the latest series of MOSS units. Thirty VOF ships and Ocean Weather Ship *Cumulus* are fitted with MOSS sets, enabling them to format their observations for automatic transmission from a Data Collection Platform. During the year, 90.7 per cent of MOSS messages were received within two hours and 99.2 per cent of the data were verified as reliable, i.e. only 0.8 per cent of the information received was questionable.

The ASAP unit on board *OOCL Challenge* was transferred to *Canmar Europe* at Montreal in March, following the iceberg collision of the former, resulting in severe hull damage and sale of the ship. J. Marr of Hull continue to man and operate the ASAP unit on board. ASAP supplies continued to be maintained on R.R.S. *Bransfield.*

2. Ocean Weather Ship

OWS *Cumulus* was manned on behalf of the Met. Office by Marr Vessel Management of Hull, and continued operating out of Greenock in her mission to provide hourly surface and six-hourly upper-air observations from the North Atlantic. On round voyages of about 35 days she normally spends one to two days in home port for crew change and storing, two to three days on passage and the remainder in the area of station 'Lima' in 57°N 20°W. Weather reports from *Cumulus*, and occasionally from VOF ships, were sometimes briefly mentioned by BBC TV weather presenters, showing their usefulness in helping to forecast the arrival in the U.K. of North Atlantic storms.

Assistance in various projects for scientific bodies continued throughout the year: on passage to and from station, the Plankton Recorder was towed for collection of these organisms for the Sir Alister Hardy Foundation for Ocean Science, Plymouth: for the Hydrographic Office, Conductivity Temperature Depth probe sampling was carried out to record sea temperature and salinity at various depths. Two drifting buoys fitted with Automatic Weather Stations were delivered to the Iceland Met. Service for their deployment.

In March, twelve Tristar Drogue drifters supplied from the U.S.A. (see Towards a Global Ocean Observing System, *The Marine Observer*, 1987, pp.76 and 77) were embarked at Greenock and deployed near the area of station 'Lima' on behalf of the Netherlands Institute for Sea Research, as part of the World Ocean Current

Experiment (WOCE). These drifters are tracked by NOAA satellites with the aim of studying surface drift in the North Atlantic with greater accuracy than before.

During the weather ship's annual drydocking period in June at Milford Haven, additional Vaisala upper-air monitoring equipment, normally used on land, was installed for use in special trials held in July and August. Using intercomparisons from Stornoway's radiosonde by radar measuring methods with the ship's LORAN and OMEGA wind-finding capabilities, the purpose of the trials was to demonstrate the ship's performance and investigate the optimum settings of the Vaisala DigiCORA system used to measure upper atmosphere winds and other elements. The results of the trial were very encouraging, showing no significant bias between the output of the various systems.

Additional responsibilities of individual members of the team of four meteorologists, out of the total manning of 18 on the weather ship, included aurora reports sent to Mr Ron Livesey, Head of the British Astronomical Association (Aurora Section), bird sightings to the Royal Naval Birdwatching Society and cetacea sightings to the Oxford and Cambridge census groups. Meteorological messages were transmitted by MOSS or Telex-over-Radio and administration traffic by the ship's SATCOM Standard-C equipment.

The excellent work of the *Cumulus* is expected to continue for several years into the future. The U.K. took over the operation of the ship at the end of 1985, when she was nominally 'purchased' for a token sum of £1 from her builders and owners, the Royal Netherlands Meteorological Institute, on the understanding that the ship would be 'sold' back to KNMI when no longer required.

3. METROUTE

METROUTE is one of the two specialist units of the Met. Office's Commercial Services Division providing services to the marine sector. The ship routeing service has again seen a significant increase in activity, with owners and charterers recognising the value to their day-to-day shipping operations of sound meteorological advice provided by the experienced Master Mariners who make up the METROUTE team. They are situated in the Central Forecasting Office at Bracknell, and so have immediate access to the global analyses and forecasts which are produced there. All advice is tailored specifically for each vessel being routed, bearing in mind the requirements and practical constraints which apply in shipping operations. In addition to full voyage routeing, the unit can also supply Tropical Storm Advisories, and special marine forecasts for activities such as surveying and towing.

4. Marine Advisory and Consultancy Service

The Marine Advisory Service is also part of the Commercial Services Division, and supplies data, expertise and advice on any aspect of past weather and marine climate, world-wide. The unit has access to extensive computer databanks containing weather observations made over all oceans, and these data can be analysed and presented in a wide variety of formats to aid decision-making in planning and design studies. Additionally, reports on past marine weather incidents anywhere in the world are prepared on request to meet the needs of the marine insurance and legal communities.

5. International Port Meteorological Officers Seminar

Held under the auspices of the World Meteorological Organization, this

inaugural week-long event attended by more than 60 delegates from 33 countries was hosted at the International Maritime Organization's London headquarters in September. The gathering was an obvious extension of national PMO biennial conferences previously held in the U.K. and the U.S.A. The inspiration and much of the preparation for the seminar came from Captain Gordon Mackie, Met. Office Marine Superintendent, following his U.K. organised meetings and his attendance at the joint U.S.A./Canada PMO conference, held at Seattle in September 1990.

The conference, attended by six of the seven U.K. PMOs, addressed the common aims of recruitment and service of merchant ships to undertake voluntary marine weather observing. Speakers from several sections of the marine industry, including IMO, ICS, INMARSAT and BT, augmented the general debate amongst the PMO delegates from countries as diverse as Canada and China, Poland and Republic of Korea, Sudan and Sweden.

Many important issues were aired, not least the subject of training of PMOs, and standardization of national practices and instruments deployed to voluntary observing ships. The latest information on satellite communications methods was given, so as to enable forecasters to receive ships' coded weather reports globally and in timely fashion.

All delegates were given the opportunity to give a brief review of their national methods and problems, producing some interesting facts on differing practices. Although a voluntary undertaking, at least one country, France, made payments for observations received: other countries made special awards in recognition of the work done on merchant ships, including diplomas, books, engraved plaques, pilot charts and barographs for long service. In some cases, shipowners are expected to supply their own instruments and rewards to observers on their ships, but this was not considered the best option to ensure reliability and accuracy of data.

At the conference, opportunity was taken to express concern at the proposed withdrawal of the Port Met. Officer at Rotterdam, leaving the largest port in the world in terms of tonnage, without local PMO representation. Miss Julie Fletcher, the much-respected PMO from Wellington, New Zealand, and the only female present at the conference, gave a very good presentation on the standardization of barometer comparison on ships.

One day of the week was devoted to visiting VOF ships in port at Southampton and to visiting the PMO's office there. Arrival of the party alongside *C.S. Sovereign* coincided with the berthing of the Cunard liner *Queen Elizabeth 2* at the adjacent terminal, and delegates were pleased to accept this opportunity for the taking of the official conference photograph. Delegates also welcomed the opportunity to receive an overview of U.K. observing methods on ships, whilst half of the party diverged to visit P&O Containers' *Oriental Bay* berthed at the Prince Charles Container Port.

At the Workshop convened at the end of the conference, several recommendations were made, some of which follow.

1. Liaison with marine industry officials should continue as a means of improving efficiency and effectiveness of merchant marine observing.
2. Co-operation in the ships-of-opportunity programme to make special Expendable Bathythermograph soundings and other particular observations.
3. PMOs to emphasize to ships' officers the importance of observations, particularly those in the data sparse areas of the Southern hemisphere, and to assist in training ships' staff in weather observing.

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Delegates to the International Port Meteorological Officers Seminar, September 1993, photographed during their Southampton visit, beside the liner *Queen Elizabeth 2*.

4. National Met. Services (NMSs) should co-operate in the preparation and publication of advertisements in marine periodicals, such as INMARSAT's *Ocean Voice*, aimed at recruiting more voluntary observing ships. NMSs should aim to comply with their published transmission schedules, including facsimile transmissions (highly regarded by seafarers) and regularly update broadcast information in user publications and their transmissions.
5. Articles and information for publication in marine meteorological journals of those countries which publish them should be sought from all NMSs and from the mariners themselves, in return for copies and reprints of the journals.
6. WMO should consider holding international PMO seminars at four-yearly intervals.
7. A complete review of WMO publication WMO/TD-No. 348, *Handbook on Marine Meteorological Services*, was carried out and many recommendations made. Amended copies of the new edition of this useful publication can be obtained from WMO, Geneva.

The seminar undoubtedly illustrated the value of international liaison and face-to-face meetings with PMO counterparts from around the globe. It resulted in a very useful exchange of ideas which will, it is hoped, have a favourable effect on the accuracy and quality of vital weather data from ships. There was no doubt amongst all delegates that more volunteers afloat were needed to make available additional accurate marine data, to satisfy the needs of both the meteorologists in their forecasts for the mariner, and the climatologists in their vital researches into the long-term prospects for the weather.

As a result of personal contacts at the seminar, PMOs at the following ports agreed to hold small stocks of U.K. stationery or instruments for issue to observing ships in need - Bergen, Copenhagen, Gdynia/Gdansk and Port Louis, Mauritius. It is hoped that a liaison with the India Met. Department will result in some of that country's ports holding stocks in future. These are most useful additions to the list of PMOs overseas who assist in this way. Publications will be updated to reflect this extra international liaison.

Dr Peter Dexter, Chief of WMO's Ocean Affairs Division, presiding over the proceedings, closed the seminar with thanks to the U.K. Marine Division for helping to make the gathering such a successful affair and the Marine Superintendent expressed thanks to all participants and organisers.

6. International and domestic activities

In April the Marine Superintendent travelled to Geneva to attend the WMO Management Group Meeting for the Composite Observing System for the North Atlantic. Later in the month he was in Lisbon for the WMO Commission for Marine Meteorology's eleventh session (CMM XI). Last held in 1989, this major WMO meeting, attended by delegates from around the world, dealt with about 40 items on numerous aspects of the subject, with many working groups and sub-committees.

Immediately following CMM XI, the Marine Superintendent travelled to San Diego, California, to present a paper on the latest developments in the introduction of the Global Maritime Distress and Safety System, to an assembly of oceanographers and meteorologists.

In the early part of the year, the Marine Superintendent offered to give expert

evidence to Lord Donaldson's Enquiry at the Department of Transport into the implications of the *Braer* grounding in the Shetland Islands, with subsequent oil pollution. In May, Captain Mackie gave a talk on the work of the Marine Division to the West of Scotland Branch of the Nautical Institute at the Glasgow College of Nautical Studies. In June he attended the drydocking of OWS *Cumulus* at Milford Haven. Amongst several other regular conference activities he represented WMO at the 39th session of IMO's Radio Communications Sub-committee in November. Captain Houghton gave a talk in December to members of the PROBUS Club, Sandown Park, Surrey, on the history and development of marine weather forecasting.

7. Publications

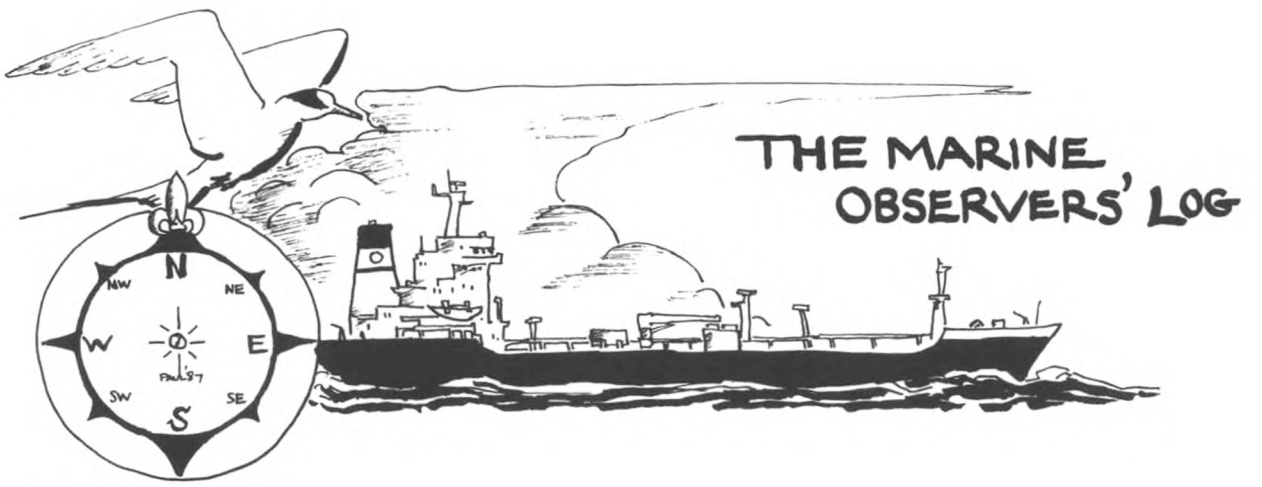
A new, 26-page, full-colour, edition of the Marine Division brochure, *Weather Services for Shipping,* was launched in January and was well received. Copies of the brochure can be obtained from Port Met. Officers or the Marine Division at Bracknell Headquarters. A new publication, *MARID Code for Sea Surface Temperature Observations from Coastal Waters* was published to replace previously typewritten instructions, for those vessels mainly in the North Sea and coastal trades, co-operating with data used in fog forecasting, and in some cases, the possibility of ice formation at sea.

Revision on reprint of publications for the Voluntary Observing Fleet was also undertaken of the *Ship's Code Card, MARID Report Form, Ship's Meteorological Logbook, Auxiliary Ship's Report Form* and the *Coastal Waters Plotting Chart,* the latter being updated in October to reflect the change of station reports in the BBC Shipping Bulletins when *Smith's Knoll* light vessel was withdrawn and replaced by Bridlington.

8. General

Inscribed barographs were once again awarded at a ceremony in Bracknell, to four shipmasters whose auspicious observing records merited such reward. Three types of book were again chosen to present as Excellent Awards to 300 Masters, Principal Observers and Radio Officers whose meteorological logbooks were assessed as of a suitably high standard during the year. *Cassell's Concise English Dictionary* (1992 edition), *Philip's International World Atlas* and *Pole to Pole* by Michael Palin (BBC Enterprises) were the books selected. The numbers of unclaimed awards from previous years continues to grow. Nominees for these awards are tabled in each year's July edition of *The Marine Observer,* and all officers connected with the VOF are requested to consult these lists again and notify us of the whereabouts of any officer who may not have claimed his or her award.

As we go to press, we hear that Dr Peter Ryder, the Met. Office Deputy Chief Executive and Director of Operations, has been made a Companion of the Most Honourable Order of the Bath (CB) in the New Year's Honours List. Dr Ryder joined the Met. Office in September 1967 and has overseen development of the computer resources, the observational system and forecasting services of the Office. He now provides the overall leadership which ensures efficient provision of the Office's operational services.



April, May, June

The Marine Observers' Log is a quarterly selection of observations of interest and value. The observations are derived from the logbooks of marine observers and from individual manuscripts. Responsibility for each observation rests with the contributor. All temperatures are Celsius unless otherwise stated. The standard international unit for barometric pressure is the hectopascal (hPa) which is numerically equivalent to the millibar (mb).

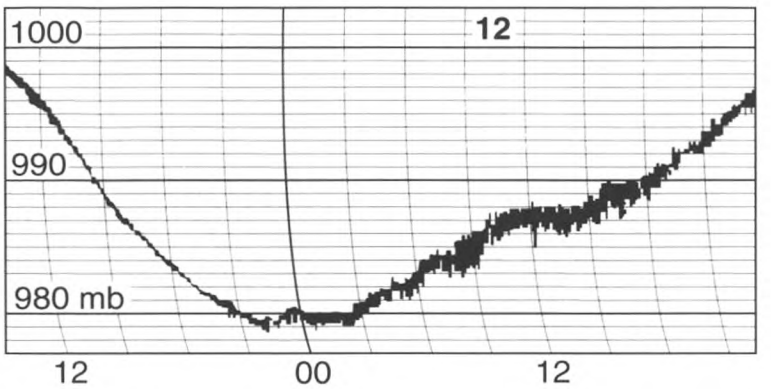
HEAVY WEATHER

Tasman Sea

m.v. *Moreton Bay*. Captain G. Peaston. Port Chalmers to Melbourne. Observers: the Master and ship's company.

12–14 June 1993. From the vessel's departure the barograph indicated pressure falling steadily, and facsimile bulletins confirmed a succession of lows traversing the southern Tasman Sea area over the next few days, with tightly packed isobars. As the vessel cleared Dog Island and started the passage west-north-west towards Melbourne, the wind picked up progressively and backed from N'ly through WSW'ly over a 12-hour period while increasing to force 7–8. At this time a predominant swell from the west-south-west was becoming evident.

Between 0400 and 1200 on the 12th the wind was steady at WSW'ly, force 9–10, and at 0600 the vessel started a progressive reduction in speed owing to heavy pitching and rolling to very rough seas and short, mountainous swells with breaking crests. At 0827, engines were at stand-by with the Master finding the most comfortable position for the vessel, and effectively hove-to making 1.5 knots on a heading of 255°, having suffered some violent rolling and pitching in the meantime. The barograph trace indicates the effects of the conditions experienced. The next 24 hours saw the wind back slowly from WSW'ly to SSW'ly at a constant force of 8–10. The barograph 'bottomed' at 2230, reading 979 mb before the pressure began a progressive rise as the depression made slow progress to the east-south-east as the vessel moved slowly west.



During this time swells were logged to 14 m, but with a bridge height of eye of 22 m the horizon was lost at times behind a number of exceptionally high swells while the vessel was still effectively upright. The vessel's course gradually came round to 220° keeping the swell 1–1½ points on the port bow, and speed maintained at 2–3 knots. Deviation from this brought a return to very heavy pitching and/or rolling owing to a continuing very rough and steep cresting swell. Between 1400 and 2200 on the 13th the wind was constant SSW'ly, force 8 but the swell was being confused by a secondary one which, by 0200 on the 14th was predominantly south-south-easterly. At 2200 on the 13th the decision had been taken to increase the vessel's speed and set course for a point north of Flinders Island, so putting the now confused swell on the quarter, and the passage was resumed.

On receipt of facsimile charts it was concluded that a very slow-moving, filling dominant high (1032 mb) was forcing a succession of depressions gradually but reluctantly east-south-east, resulting in a gradient of 52 mb being 'squeezed' into a small band east and north of Tasmania, bringing far higher winds than predicted by coastal weather stations and catching the vessel in the middle and making her somewhat uncomfortable, to say the least.

Position of ship at 0927 UTC on the 12th: 40° 38′S, 153° 25′E.

THUNDERY WEATHER

Indian Ocean

m.v. *British Resolution*. Captain J.E. Perry. Das Island to St Lucia. Observers: the Master, Mr S. Petty, Chief Officer, Mr C. Beaton, 2nd Officer, Miss R.V. Nelson, 3rd Officer, Miss J. Tyson, 3rd Officer and ship's company.

21 May 1993. While the 0600 UTC report was being prepared, the vessel on a course of 207°, encountered what appeared on the radar to be small rain clouds. On entry into the clouds the vessel was met by heavy rain, thunder and sheet lightning which lasted for about an hour.

Later on in the day, at around 1000 the vessel again encountered heavy rain, and the Second Officer noted that the wind had changed direction from SW'ly to N×E'ly. As the afternoon progressed, the rain became heavier with lightning again present, and the Chief Officer observed that the wind speed was constantly changing through force 2–5 while at the same time the appearance of the sea was changing from slight to rough, although the swell remained constant throughout.

During the early evening at approximately 1400, the rain became heavier still, accompanied by fierce lightning that 'seemed' to penetrate into the vessel including the smoke room, where a number of officers commented on its intensity. The visibility began to fluctuate between a few miles and in excess of 10, with an average of 7 n.mile, and the Master noted a peculiar trace on the barograph whilst the Third Officer on the 4–8 watch found that the wind was constantly changing direction between SW'ly and N'ly.

The Third Officer on the 8–12 watch observed that the wind remained N'ly, pushing the funnel smoke well clear of the front of the wheel-house, and that the vessel's speed which had been averaging 13.5 knots, had increased to 15.2 knots. The lightning was now constant and, as it flashed, it lit up the whole sky so that the vessel appeared to be sailing in daylight. The ship seemed unable to 'shake off' the storm cloud following and was occasionally overtaken and engulfed in drenching rain with visibility reduced to a few hundred yards. A constant radar watch was kept, to the Master's orders, and a large cloud bearing 230° at a distance of 20 n.mile was seen apparently moving towards the vessel despite the wind being from astern. This new cloud followed a course on a S'ly wind until it reached the ship and was watched on radar as the two seemed to converge.

It was at about this time, approximately 1800, that the storm cloud following the vessel started to lose its energy. Ahead, the cloud appeared to end in a dark, straight edge leaving a gap of lighter sky of roughly 10° between it and the horizon. A vessel had been noted on radar and its progress was monitored; at 1830 its foremast lights were sighted visually at a radar range of 17.4 n.nile and this vessel disclosed that the weather ahead was 'fine and clear' with very good visibility.

As the *British Resolution* left the storm clouds and passed under the dark edge, the rain abated then stopped. The lightning continued although it was now astern and as soon as the vessel left the storm area the wind changed to its previous direction of S'ly. As the watch was handed over the weather became more pleasant and, as the new day dawned the weather reverted to how it had been for the previous week, with SW'ly winds of force 4–5.

Throughout the day there had been only occasional thunder-claps while the temperature, although cooled by the storms, remained quite warm with the rain and wind feeling warm to the skin.

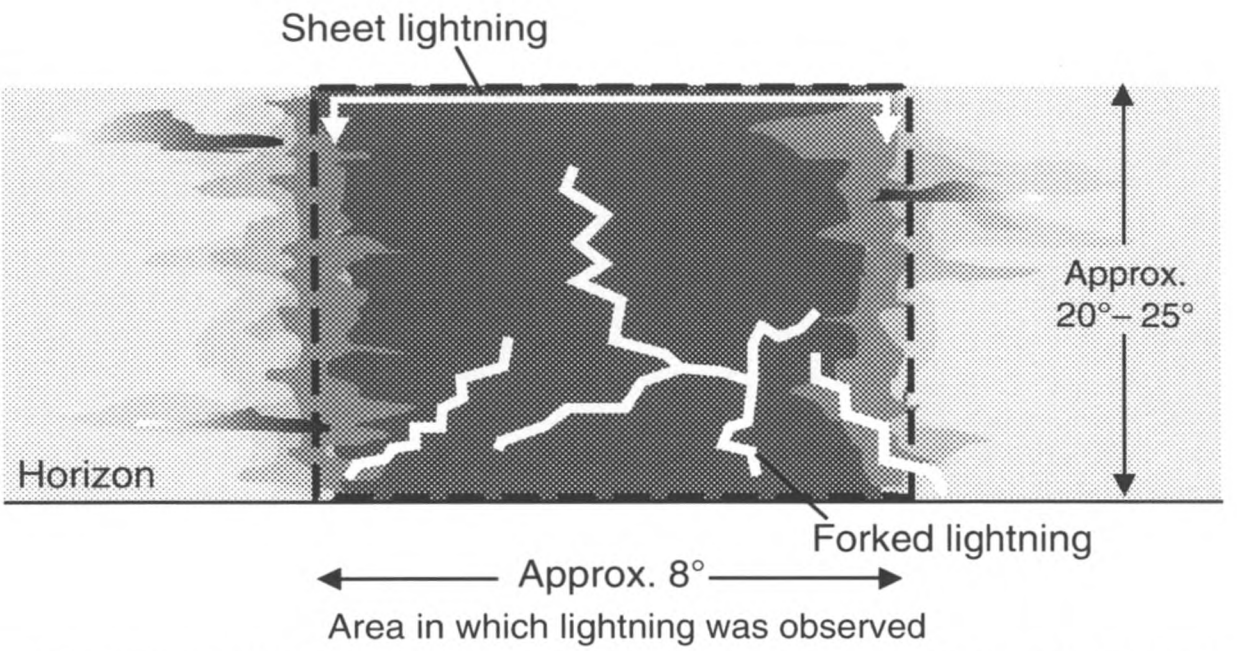
Position of ship at 0600 on the 21st: 06° 24'N, 52° 06'E.

LIGHTNING

Indian Ocean

m.v. *British Resource*. Captain M.R. Mansbridge. Galveston to Ras Shukheir. Observers: the Master, Mr M. Murphy, 3rd Officer and Mr M. Williams, A.B.

2 April 1993. At 2100 UTC the loom of a light was reported on the port quarter but the vessel's position and course caused some doubt to be attached to the observation. However, after several minutes the loom was seen to grow in intensity until it occupied a rectangular area about 8° wide and 20–25° high, whilst within this area a clearly-defined orange colour almost identical to the effect of the setting sun on a cloud bank, was seen. See sketch.



The light was identified as lightning of both the sheet and forked varieties, both apparently alternating and occasionally overlapping. The sheet lightning had the same intensity of colour as a direction indicator lamp in thick fog, whereas the forked lightning was very well defined with its angular steps being clearly visible. For approximately 30 minutes the lightning appeared to stay within the confines of the rectangular area but then the forked variety ceased and the sheet lightning dissipated to a more normal colour and pattern. Throughout the observation no thunder was heard and by 2230 the intensity of the lightning was sufficiently lowered to be barely visible on the horizon.

Weather conditions at the ship were: dry bulb 25.2°, pressure 1016.6 mb, wind NE'ly, force 3, cloud cover was 8 oktas cumulus and stratocumulus with a base of roughly 2000 feet. The course and speed of ship was 037° at 14 knots.

Position of ship: 26° 39′S, 34° 46′E.

CURRENT

Indian Ocean

m.v. *Tricula*. Captain R. Firth. Richards Bay to Singapore. Observers: the Master and members of ship's company.

28–29 April 1993. At about 0200 UTC while steering 069° it was noted that the vessel's course keeping was starting to degenerate; settings on the automatic pilot were adjusted but to no avail. During the day the steering became more erratic as occasional rips or disturbances were observed on the surface of the sea. The most severe effects were noticed on the 28th from 2200 until 0000, in mean position 07° 39′S, 59° 06′E when the vessel's head was being frequently deflected by up to 10° and hand steering was required to enable the course to be regained. At the same time, the speed was reduced to about 12.2 knots over the ground (13.2 knots through the water).

The effect gradually diminished during the morning of the 29th, and by 1300 when in position 06° 29′S, 62° 10′E, no more sea surface disturbance could be seen and the vessel's course keeping was back to normal.

It was thought that the phenomenon was probably caused by the South Equatorial Current, but neither the Master nor the three navigating officers who

witnessed the effect had encountered such a severe or prolonged spell of bad steering owing to a deep sea current on any previous occasion. At its most severe, the effect on the course keeping was so extreme that the mechanical integrity of the whole steering gear and control system was seriously called into question.

Whilst on passage, the *Tricula* had a displacement of 140,000 tonnes, draft of 16 m even keel and still water speed of 13.4 knots. Throughout the period the weather was as follows: calm, or light breezes up to a maximum of SE'ly, force 4, slight sea, low to moderate swell of average length, sky partly cloudy (less than 4 oktas).

Position of ship at 0200 UTC on the 28th: 09° 10'S, 55° 04'E.

CETACEA

Indian Ocean

m.v. *Oriental Venture*. Captain R.A.W. Jarrett. Rotterdam to Persian Gulf. Observer: Mr J.H. Donne, 2nd Officer.

15 May 1993. At 1100 UTC whilst 50 n.mile off East London, steaming north-eastwards at 14 knots, a school of 10 Killer Whales was sighted 500 m off the port bow. The school was proceeding in the same general direction as the ship but at a slightly slower speed, and was unconcerned about the ship until 100–200 m off when the individuals dived deeply before appearing 300 m off the starboard beam about two minutes later.

They appeared to be a family group as there were several much smaller whales in the company of one very large one, and also three or four others of moderate size. They were identified by the distinctive high dorsal fin and the black body colour with white patches. The observer could not recall Killer Whales in such numbers before.

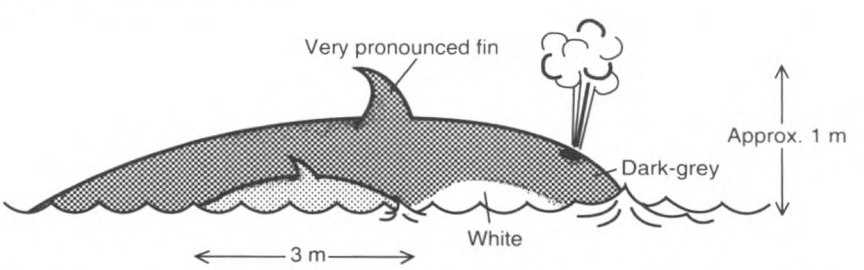
At the time of the observation the sea height was 0.5 m and the sea temperature was 23.3°.

Position of ship: 33° 55'S, 28° 10'E.

North Pacific

m.v. *BP Admiral*. Captain J.M. Ronald. Chiba to San Francisco. Observers: Mr J.M. Cleugh, Chief Officer, Mr P. Collings, 2nd Officer and Mr P.M. Belcher, 3rd Officer.

12 June 1993. At 2100 UTC two whales on a course of about 070° were sighted close on the port side of the vessel. Their species was unknown, but there was a larger one of which about 10 m was visible accompanied by a smaller whale swimming alongside, see sketch.



No flukes were visible but the whales had very elongated bodies, and slight ridges aft of the very prominent dorsal fin were seen during diving; the larger one

was seen to blow three or four times. Their bodies were dark-grey to black in colour on the upper sides, and a lighter cream colour underneath but they were definitely not Killer Whales.

When they breached the surface their movement was long, slow and lazy and they appeared to be totally unconcerned about the presence of the vessel. At a distance of about 1 n.mile they finally sounded and were not seen again. The wind was SW'ly, force 2 and the sea temperature was 18.0°.

Position of ship: 35° 00'N, 172° 21'W.

SHARK

South Atlantic Ocean

m.v. *West Moor*. Captain D. Johnstone. At anchor, Ascension Island. Observers: the Master, Mr M.J. Clark, Chief Officer, Mr G. Manguabat, 2nd Officer and ship's company.

2–3 June 1993. At 1600 UTC whilst at anchor in a water depth of approximately 45 m a Whale Shark (identified from *The Seafarer's Guide to Marine Life*, by P.V. Horsman) was observed swimming around the stern and both quarters of the vessel. The shark was estimated to be approximately 8–9 m in length and about 1–1.5 m across the head; on several occasions the shark broke the surface of the water and its large tail fin (roughly 70 cm in height) and dorsal fin were clearly visible. The markings on the upper surfaces of the shark showed a dark-green mottled appearance with regular white spots all over it. The fish was accompanied by about 12 pilot fish which could not be more accurately identified.

From 1600 until 2000 the shark remained in the vicinity of the vessel but disappeared at the onset of darkness. The following morning it reappeared briefly for about two hours but was probably influenced by the noise of motorised barges working the ship and passing close astern of the vessel.

The previous afternoon, the Master and Chief Officer had been snorkelling around the stern area to inspect underwater growth and fouling; needless to say, if a head-on encounter with the fish had taken place, the results would have been interesting — plankton-feeder or no plankton-feeder.

Weather conditions at 1600 UTC on the 2nd were: dry bulb 27.0°, pressure 1014.9 mb, wind SE×S'ly, force 4, few clouds. The sea was slight with a low swell.

Position of ship: approximately 05° 48'S, 14° 48'W.

JELLYFISH

North Pacific Ocean

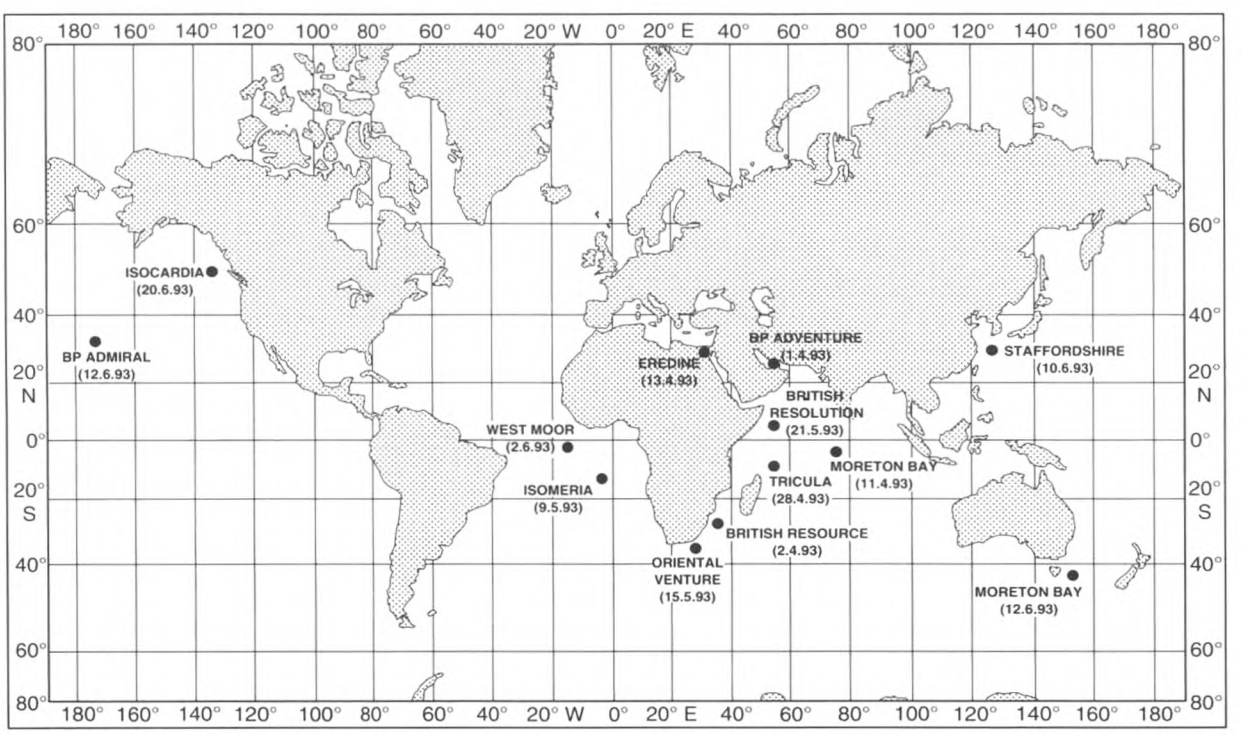
m.v. *Isocardia*. Captain P.N. Bowden. Sendai, Japan to Ferndale. Observers: Mr S. Gallaway, Chief Officer, Mr A. Villaflor, A.B. and members of ship's company.

20 June 1993. Between 1350 and 1405 UTC the sea was covered in what first appeared to be detergent bubbles. These 'bubbles' were lying in clumps and strings, and closer investigation with binoculars revealed that they ranged in size from very small to about 10 cm in length, but with a height of eye of 30 m it was hard to be accurate.

The latter, larger 'bubbles' closely resembled the shape of a miniature Portuguese man-of-war in that they were semi-transparent and of the silvery-blue colour that the observers associated with jellyfish. The ship's bow wave kept them well clear of the side, so no samples could be obtained but photography was attempted.

At the time of observation the sea was almost smooth and there was a swell from 270° at a height of 2 m. The sea temperature was 11.8° and the wind was SW'ly, force 2–3.

Position of ship: 48° 59'N, 132° 15'W.



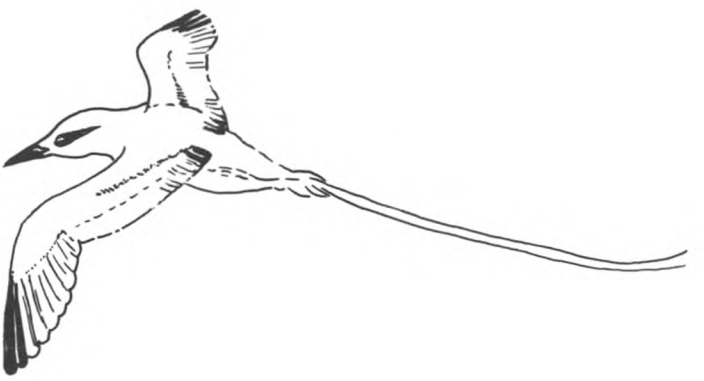
Position of ships whose reports appear in the *Marine Observers' Log*

BIRDS

Indian Ocean

m.v. *Moreton Bay*. Captain D.S. Hughan. Fremantle to Jeddah. Observers: Mr G.H. Smith, 3rd Officer and Mr S.C. Parsad, Radio Officer.

11 April 1993. At 0500 UTC a small, white-coloured bird was observed flying around the ship. On closer examination through binoculars the following points, as shown in the sketch, were observed: the whole bird was basically a brilliant-white colour with the exception of some black patches; the bird's body was approximately 40–50 cm long with a tail that was about 1½ times longer again; the upper and lower mandibles were black, as were its distinctive eyestripes; the wings showed black primaries and secondaries.



The bird was identified as a White-tailed Tropicbird from various sources of literature on board and, having circled the ship for about two hours, was last seen flying in the direction of Chagos Archipelago/Diego Garcia.

Position of ship: approximately 03° 36′S, 72° 54′E.

Note. Captain P.W. Chilman, of the Royal Naval Birdwatching Society, comments:

'This was a White-tailed Tropicbird (*Phaethon lepturus*) which is the smallest and most graceful of the tropicbirds; it ranges far over the oceans and is often attracted to ships. It is found in most parts of the tropical oceans, although scarce in the eastern Pacific, and breeds on islands. The bird is rarely seen on water although when it does settle, it rides high with its tail cocked.'

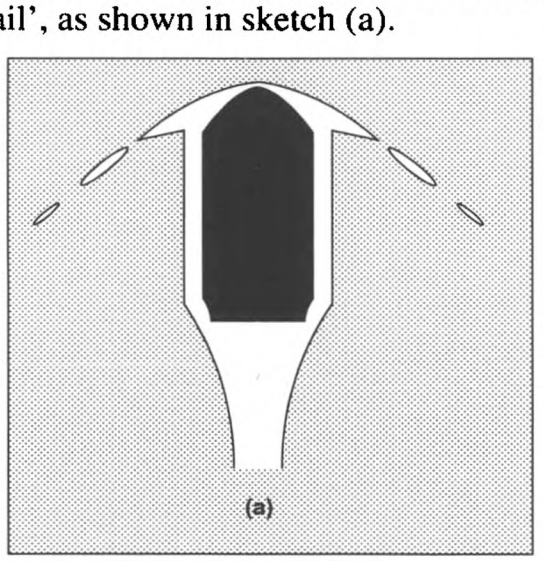
BIOLUMINESCENCE

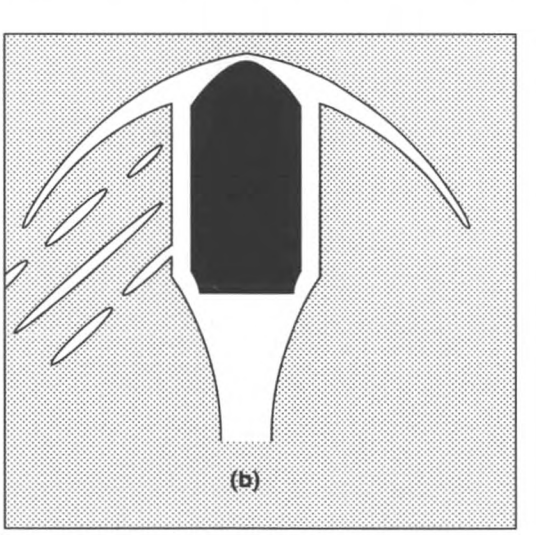
Persian Gulf

m.v. *BP Adventure*. Captain K.E. Peacock. Mina al Ahmadi to Fujairah. Observers: Mr A. Hirst, 2nd Officer and members of ship's company.

1–2 April 1993. Between 2000 UTC on the 1st and 0200 on the 2nd, bioluminescence was observed to surround the ship.

Starting with the bow wave and then proceeding down the ship's side was a band about 2 m wide; the first metre along the side gave off the strangest light, the next metre was less intense and after this it gradually faded away. The light continued in the ship's wake for about 100 m, leaving the ship with its own 'snail trail', as shown in sketch (a).





At 0100, waves of bioluminescence were observed at the stern on the port side, coming from a north-easterly direction, as shown in the second sketch. These corresponded with the wind waves which at this time were generated by a NE'ly wind, force 3–4, giving waves of about 0.5 m high.

During the period the wind changed from light and variable to NE'ly, force 4, but the bioluminescence remained constant in intensity, producing a white light strong enough to light up the ship's side. Throughout the observation the air reeked strongly of fish.

Position of ship: 26° 08'N, 54° 58'E.

East China Sea

m.v. *Staffordshire*. Captain J.R. Hughes. Mina al Ahmadi to Daesan. Observers: the Master, Mr M. Malone, 3rd Officer and members of ship's company.

10 June 1993. At about 1330 UTC slight bioluminescence was observed surrounding the vessel, being most prominent amidst the bow wave. After a while the intensity began to increase, and at approximately 1430 extremely bright, rapid flashes were observed to a distance of roughly 1 n.mile around the ship. There was an E'ly wind of force 3, and the luminescence seemed to follow the breaking crests of the wavelets; its appearance was green/blue in colour with each flash lasting for about 1 second.

A sample of sea water was taken which, when stirred in glass with a spoon, showed about 10 'lights' revolving with the movement of the water. Each light was oval in shape and about five times longer than wide, the total length was estimated to be roughly 1 mm. Once the stirring was stopped the lights diminished but the spoon then glowed for 15 seconds or so. Shining the Aldis lamp had no stimulating effect on either the sea or the water in the glass.

There was no difference between the windward and leeward sides in the frequency of the luminescence, but the effects seemed to be much brighter on the leeward side, both colour and light being more intense.

The display persisted for another hour before suddenly disappearing. Looking ahead of the vessel, a line had been sighted on the surface and showed where the luminescence stopped. No apparent reason could be found for the sudden change, the sea state, wind conditions and water depth remained constant but there was obviously a significant reason for the phenomenon's end because it was so abrupt.

Position of ship: 29° 30'N, 123° 41'E.

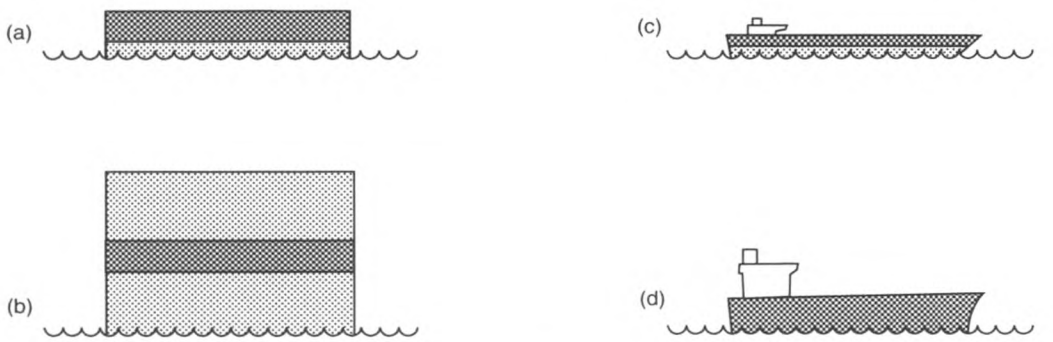
ABNORMAL REFRACTION

Gulf of Suez

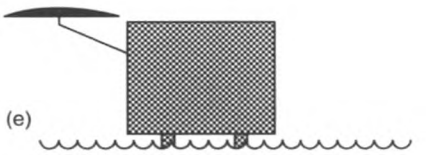
m.v. *Eredine*. Captain P.A. Frewer. Juaymah to Ain Sukhna. Observer: the Master, Mr M.R. Pearson, 2nd Officer, Mr W.C. Chung, 3rd Officer, Mr R.P. Bradsell, Radio Officer and Mr I. Fyfe, 2nd Engineer Officer.

13 April 1993. During transit of the Gulf of Suez an exceptional display of super refraction which gradually encircled the vessel was encountered between approximately 0945 and 1300 UTC. Ahead, the horizon became elevated and, as the refraction developed, the land on either side experienced 'stretch marks' at mid-height. A vessel observed 1 point on the starboard bow initially showed no accommodation, but became inverted about its main deck and was then first

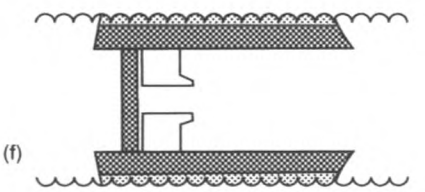
stretched and then compressed vertically. The effect remained until the vessel was about 4 n.mile off, whereupon it revealed its true size and shape (see sketches (a) to (d)).



Shortly afterwards an oil rig was observed to be vertically stretched to approximately three or four times its true height while its flare appeared to burn horizontally rather than vertically, see sketch (e).



Finally, a south-bound handy sized tanker was passed and, as its distance astern increased, it showed an inverted image which remained joined at the funnel, see sketch (f).



The phenomenon gradually broke up after 1130 although isolated patches occurred until sunset. A few days earlier an example of extreme visibility had been noted when the Chief Officer saw what was thought to have been an islet silhouetted against the setting sun. The 'islet' was subsequently identified as mount Hayd Ash Sharif, a mountain some 84 n.mile distant.

Weather conditions at the time of observation on the 13th were: air temperature 25.6°, wet bulb 15.9°, dew point 7.4°, pressure 1015.4 mb, wind light and variable.

Position of ship: 29° 00′N, 32° 50′E.

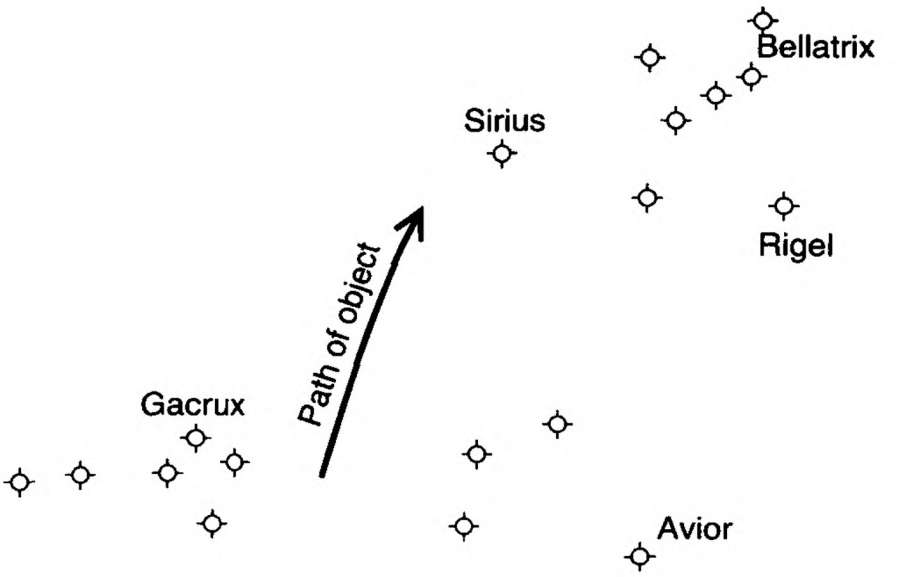
METEOR

South Atlantic Ocean

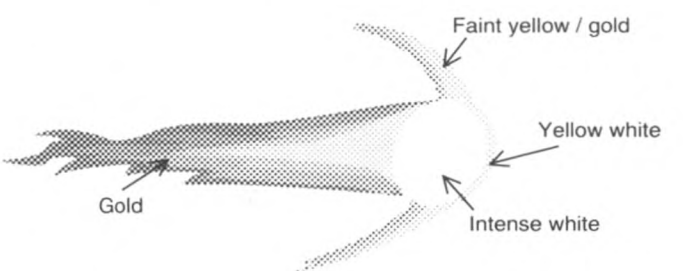
m.v. *Isomeria*. Captain T.P. Doherty. Westernport to Tarragona. Observer: Mr R.E. Parker, 3rd Officer.

9 May 1993. At 1945 UTC a large bright meteor was sighted on the port side of the vessel. Appearing between the Southern Cross and Avior, it proceeded to

travel for approximately 2–3 seconds towards Orion, as shown in the first sketch, but was then lost to sight owing to the unfortunate circumstance of the observer being on the opposite bridge wing.



During the period in which it was visible, the head of the meteor was noted to be brighter than any other star or planet then visible, and seemed to be more slow moving in its travels than average meteors spotted earlier. As indicated in the



second sketch, the head was a 'bright' white with slight orange/yellow tinting to the forward edge; the tail, which stretched for 1–1½° of arc was gold or golden-yellow, and remained constant throughout the observation. The sky was clear and there was no wind.

Position of ship: 12° 51′S, 01° 15′W.

551.46(261.26)

Understanding the North Sea System*

Preface

On 4 and 5 November 1992 a scientific meeting on 'Understanding the North Sea System' was organized by, and held at, The Royal Society. What follows was prepared after the meeting by The Royal Society and The Association of British Science Writers, to summarize key issues raised by the speakers. The Editor of *The Meteorological Magazine* is indebted to Dr S.J. Foreman of the Meteorological Office for contributing additional comments and explanations and to Valerie Doodson of the Proudman Oceanographic Laboratory for the chart and trapping a few residual errors.

Introduction

The North Sea is but a puddle compared to the world's mighty oceans. But to the countries around it, and Britain in particular, it is a source of food, energy and recreation as well as a sink for all manner of waste. It was therefore appropriate that scientists embarked, in 1988, on a project to understand the North Sea more thoroughly and in more detail than any large sea has been understood before.

The North Sea is a shelf sea — that is to say it lies not over the thin crust of the deep ocean but what is essentially a submerged continuation of the European continent. It is possible that convection in the Earth's mantle at about the time that the North Atlantic opened almost caused an ocean to open up where the North Sea now is. The result was a stretching of the Earth's crust so that the upper surface sagged and filled with sediment and the underside rose bringing heat up to bake the sediments, maturing reserves of oil and gas in the process.

Today, an emerging realization of the practical and economic importance of the Sea is coupled with concern about the health of the environment of these waters. In order to understand the interactions of both aspects, scientists are faced with the challenge of discovering the processes which control that environment. The 'North Sea Project', a major research initiative managed by Britain's Natural Environment Research Council, aimed to gather enough information to be able to set up a model of the North Sea through which to reveal the impacts of agriculture and industry as well as natural processes, and to understand the consequences of our actions in the future. What has resulted is not a physical model of the sea but a numerical model in a supercomputer. All the processes are represented by calculations and by changing the numbers it should eventually be possible to work out the real changes that could arise as a result of political action or inaction.

Motivation for the North Sea Project thus came about both from strategic necessity and from a need for fundamental science. No sea, and particularly no sea so closely linked with land and human activity, can be considered in isolation. There are constant interactions through rivers and coastal discharges, from the air, from the underlying sediments and within the water column itself. Such processes

* Reprinted from *The Meteorological Magazine*, July 1993, by kind permission of the Editor.

were very poorly understood and the North Sea offered the possibility of combining new and fundamental scientific research with something that has a high profile in the public mind.

Inputs and outputs

The North Sea is an environment under pressure. It receives a huge input of what, to man, is waste but, to marine algae are nutrients: human and animal sewage and nitrates washed from well-fertilized fields. The River Rhine alone contributes about a million tons of nitrate every year and until recently that output has been doubling every fifteen years. The result is often good news for the marine algae or phytoplankton that use nitrate as food. With the summer sun to aid their photosynthesis they can multiply on a tremendous scale and sometimes, particularly along the Dutch and German coasts, produce great foaming blooms reminiscent of pollution by detergent. In theory these might consume all the oxygen from the water, leaving it anoxic. In practice, so far at least, the blooms are very localized and only slight oxygen depletion has been observed around the Dogger Bank and the German Bight, and that does not last long.

Algae in their turn are food for marine animals. They are grazed upon by microscopic zooplankton which in turn are consumed by tiny predators and so on, up the food chain to fish. But fish have been removed from the North Sea at a phenomenal rate. At present one fish out of three is caught every year. The long-term result of that has not only been a decline in all fish, but also a change in the balance of species, from herring and halibut to fish such as sandling that are usually processed industrially into animal feed.

In 1988 the plight of the North Sea was given widespread publicity as a result of the death of hundreds of seals around its shores. Ironically, this was almost certainly due to an epidemic of viral infection and not directly to pollution, but it placed the North Sea Project, which began in the same year, centre stage.

The North Sea Project

For fifteen months between August 1988 and October 1989, the Royal Research Ship *Challenger* (Fig. 1) worked exclusively on the North Sea Project, sailing a

Photo. by Terence Soames (Cardiff) Ltd

Figure 1. RRS *Challenger*

3200 km course around the southern North Sea every month. Each circuit lasted for twelve days and RRS *Challenger* was able to visit up to 120 separate sampling stations. At each, instruments were lowered over the side and data were recovered from moored instruments. For the other half of each month, the floating laboratory concentrated her attention on studying specific processes in more detail: the physics and chemistry of the sea, the interactions between air, sea and sediment and the biology of the waters.

A series of special instruments was developed to accomplish this. Principal among them was a structure weighing a quarter of a ton and including sensors for temperature, salinity, dissolved oxygen, the chlorophyll in plankton and the clarity of the water, together with ultra-clean sample bottles that could be filled at different depths beneath the ship. It is a tribute to the crew of RRS *Challenger* that they deployed this at most stations, even in gale-force winds.

Another essential instrument was Seasoar, a device resembling a small, stubby-winged aircraft that could be towed behind RRS *Challenger*. Thanks to special hydrodynamic faring on the towing cable, Seasoar could be used whilst the ship was cruising between sampling stations at her full, if leisurely, speed of 9.8 knots. By angling the 'wings', it was possible to steer Seasoar up and down to take measurements at different depths. Perhaps most valuable of all, though less obvious, was the simple fact that all the measurements were carried out from the same ship with the same instruments calibrated to the highest standards, so the results could easily be combined into a single comprehensive database on the North Sea. Those processed data are now available internationally on a compact disc.

The dynamic sea

In the south, the North Sea is typically no more than 40 metres deep. In the north it can be deeper than 100 metres. That is deep enough to cause complex problems for divers and oil companies installing offshore production platforms, but to an oceanographer it is shallow indeed. The North Sea is also almost entirely surrounded on three sides by land. Yet into that enclosed basin comes a huge input of energy. The tides supply about 50 gigaWatts. That is roughly the total electricity consumption of the whole of the United Kingdom. It is manifested not only as the twice daily rise and fall of sea level but also as a powerful stirring force. It lifts sediments and mixes chemicals through the water column. At the same time, the sea surface is also stirred by the wind.

Energy also comes from above as the sun warms the surface, particularly in the summer. That tends to make a layer of warm water develop at the surface. Because this warm water is less dense than the body of the sea below, it stays there. This kind of layering is known as thermal stratification. Further stratification can arise from salinity. In the North Sea, there is a constant battle between the sun's energy causing stratification and tidal energy mixing the water up. In the north, the sun wins and the surface of the sea remains comparatively warm and unmixed. In the south, tidal energy mixes the entire water column so the sun must heat more water and surface waters are cooler. The mixing in the south also stirs up more sediment so the water is less clear. That stirring process, together with input from rivers in the south, makes more nutrients available to stimulate algal growth.

Where the stratified northern waters and the mixed southern waters meet, they form a front, a region of sharp horizontal temperature gradients similar to fronts in the atmosphere. During the North Sea Project, RRS *Challenger* sailed to and fro

across one of these fronts which typically runs down the Yorkshire coast and then across from Flamborough Head towards The Netherlands. Complex eddies can develop along it and biological activity in the form of plankton rises and falls depending on the temperature, clarity and availability of nutrients. In some places warm, clear water from the north and nutrients from the south provide just the right conditions for a bloom of phytoplankton such as coccolithophores.

The tidal rise and fall in the North Sea due to astronomical effects was predicted last century by Lord Kelvin and is one of the easiest things to model numerically. More recent models include the effects of the wind and are accurate to less than half a metre and regular predictions (from a model developed by the Proudman Oceanographic Laboratory (P.O.L.)) are issued by the UK Meteorological Office. Such models are also useful for tackling the harder problem of the fate of pollutants.

There is an overall anticlockwise circulation in the North Sea (see Fig. 2). Currents are fastest along the Norwegian coast where the maximum is about 13 km per day, but typically the flow is only a few kilometres per day and pollution can remain in the confines of the Sea for up to three years. During the North Sea Project, current measurements were taken from the ship, from moored instruments

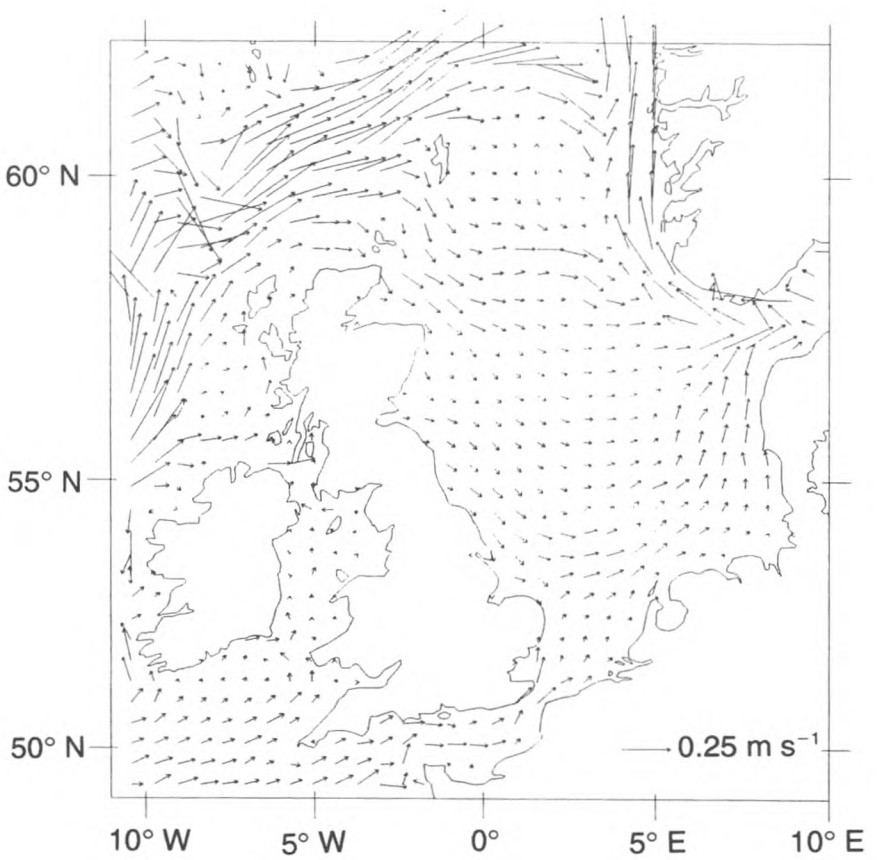


Figure 2. Mean surface currents (0–10 m depth) for January from a 3-D numerical model.

and by tracking free-floating buoys using satellite or radio navigation systems. There were mechanical current meters, acoustic Doppler current meters and radar current meters. Traces of radioactive caesium discharged from the nuclear reprocessing plant at Sellafield were tracked rounding Scotland and entering the North Sea. The flow through the Strait of Dover was monitored by radar from May 1990 to August 1991.

Vanishing sediments

The North Sea is muddy. It is not simply mud washed down in rivers. A large amount is stirred back into suspension from the sea floor or eroded from coasts. It provides a major constraint on the biological productivity of the waters by clouding them so that sunlight cannot reach algae far below the surface. The mud particles also perform important roles in absorbing chemicals such as metals and pesticide residues and thus remove pollutants from the water column. The sediments also store and release nutrients, continually recycling them into the marine environment.

One of the major surprises in the North Sea Project was the scale of sediment transport. At any one time in the summer there is about a hundred million tons of sediment suspended in the North Sea. In the winter, as gales whip up the waves and tides scour the bottom, the suspended sediment rises fourfold (the organic component remains roughly constant, the change is basically due to mud). The nett loser in this process is the British coast between Suffolk and Yorkshire, particularly the Holderness coast. Between them, they lose 6 million tons every year, most of which is transported across the sea towards the German Bight where it is deposited around the Frisian Islands. A lot of the pollutants are probably deposited here also, locked up in the sediments.

Interactions with the air

Rivers may supply most of the chemicals that enter the North Sea but a substantial quantity also comes from the air. The shallow sea with a large surface area, its waves and roughness, plus wind and rain all conspire to transfer soluble gases into the sea. If it were just a physical process, it would soon reach equilibrium with as much gas coming out of the sea as goes into it. But chemical changes take place which remove some of the dissolved gases from the balancing mechanism.

Carbon dioxide, for example, is taken out of solution by plankton which use it through photosynthesis to build their cells. They die, sink and decompose or are eaten by larger organisms. Eventually, a lot of the carbon gets recycled back to the atmosphere but some sinks to the bottom and is removed from circulation. During the North Sea Project, the scientists attempted to measure the rate at which carbon dioxide is removed from circulation. Before humans started burning fossil fuels and felling forests in large quantities, it is probable that the carbon cycle balanced. Now, we are releasing billions of tons of extra carbon dioxide every year. But it is not all remaining in the atmosphere and adding to the greenhouse effect. About half of the extra is somehow removed and it was assumed that the principal mechanism for this was through the microscopic plants in marine plankton. Measurements during the North Sea Project showed that this route only accounts for about 30% of the excess carbon dioxide. So perhaps processes on land, and in particular in forests, may account for more than anyone realised, making their destruction all the more serious.

The atmosphere supplies oxygen too; the oxygen that fish and other animals require, and the oxygen used as organic material decomposes. A fear that is frequently expressed in connection with the North Sea is that nutrients, such as nitrates and phosphates, washing into the sea from human activities, will stimulate the growth of plankton which will in turn die, sink to the bottom of the sea and decompose, using up oxygen from the water. In theory, that could lead to what is known as eutrophication — the water might become so starved of oxygen, at least

at depth, that it becomes stagnant and smelly, changing the chemistry of its interaction with the sediments on the bottom.

That is already happening in parts of the Baltic where, each spring, organic material from the plankton blooms builds up below the surface and uses up all the oxygen. Since they cannot oxidise further, the nutrients remain suspended or dissolved in the water and if they were stirred up again by storms and brought back into the sunlight near the surface, they might not only create a stink but also produce a slime near the surface.*

During the North Sea Project, the scientists found that oxygen depletion was indeed occurring in the North Sea, on either side of the Dogger Bank and close to the coast of The Netherlands. But they doubt that a larger eutrophic zone is likely to develop because of the powerful tidal mixing which brings fresh oxygen throughout the water column.

The North Sea gives out gases as well as soaking them up. On the top deck of RRS *Challenger,* well forward of any contamination from the ship, was equipment from the University of East Anglia consisting essentially of lengths of plastic drainpipe connected to a vacuum cleaner. What it was actually doing was drawing the sea air in through a series of physical and chemical filters so that researchers could study traces of organic chemicals, metals and acid gases. Chemicals dissolved in rainwater were also analysed. One of the more surprising findings of this project was that the North Sea makes a considerable contribution to the problem of acid rain.

The phytoplankton breathe out dimethyl sulphide, a sulphur-containing gas which easily breaks down in the air into a variety of other gases, such as sulphur dioxide, and eventually gives rise to cloud condensation nuclei. These can dissolve in rainwater and fall as acid rain. The North Sea scientists calculated that the sea contributes as much as 25% of the sulphur that falls over Europe as acid rain. That still leaves three times as much coming from land, mostly from power station chimneys, so does not absolve humans of responsibility for acid rain. But it does mean that, however strict the curbs on man-made emissions, a residue will persist.

The dimethyl sulphide production is strongly seasonal, following the spring phytoplankton blooms. These are encouraged by nitrates washed out with sewage and agricultural run-off. So ultimately, human activity is at least partly responsible for this source of acid rain too. It illustrates how complex the interactions are both within the North Sea and between mankind's various activities.

A model for the future

The wealth of data from the North Sea Project has been fed into a Cray supercomputer by scientists at the P.O.L. The numerical model of the North Sea developed by P.O.L. now fits the observed facts with considerable precision. The horizontal currents, the vertical mixing, temperature, salinity, air and sediments are all represented. The aim is that, for any set of starting conditions, the computer will calculate how the real sea will develop. Once that is achieved, the scientists will have what they call a water-quality model. They will be able to program in various different political scenarios such as curbs on the use of nitrates or the discharge of sewage and see what their impact will be at sea.

The North Sea has a vast capacity for absorbing and treating the wastes we discharge into it, but that capacity cannot be infinite. At present, the great saviour is the natural stirring of the sea. It disperses pollutants and stirs up sediments so that light does not penetrate very deep, limiting phytoplankton to the surface. Thus

they do not normally grow out of control in spite of abundant nutrients. The slimy froth of Phaeocystis plankton washing up on the shores of The Netherlands , and the eutrophication of water sheltered by the Dogger Bank are warnings that limits cannot be safely exceeded. Just what those limits are, and how the resources of our local sea can best be managed, should emerge from the computer models in the years to come.

The pioneering work performed on the North Sea will have applications far beyond our shores. Canada's Gulf of Maine, the Patagonian Shelf off Argentina and China's Yellow Sea are all examples of shelf seas to which many of the lessons learned in the North Sea will apply. Ultimately, even the best science will have to be supported with the political will to preserve the quality of such waters.

* Readers wishing to learn more about air–algae–ocean interactions are recommended the article in New Scientist of 21 August 1993.

Shepherding Sperm Whales to safety*

BY DR TONY MARTIN

(Sea Mammal Research Unit, NERC, Cambridge)

In the last week of February news began to filter through to the Sea Mammal Research Unit of an alleged sighting of six sperm whales in Scapa Flow, Orkney. Whales are often misidentified, and because the sperm whale is an animal of deep oceanic waters, the suggestion that a large group had somehow got into an almost land-locked lagoon in shallow shelf waters was initially greeted with scepticism. How wrong we were. By early March there was no longer any doubt. The only thing that made sense was that the animals were, by their enormous size, clearly males; females and youngsters rarely venture outside low latitudes in either hemisphere.

Just why and how six 40-tonne, apparently healthy, bull sperm whales came to be in Scapa Flow was, and remains, a mystery. The whole of the continental shelf, including the North Sea, is normally too shallow for this species. At less than 60 m depth, Scapa must have seemed little more than a puddle to whales that are capable of diving to 2,000 m. Perhaps they had been swept through the relatively narrow entrance by the strong tidal current, but that did not explain why they were so close to land in the first instance.

At first, the whales were greeted with excitement both by the Orcadians and the rest of the world, represented by a large media entourage. Many assumed that the animals would find their own way out, but those familiar with sperm whales

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thought this unlikely because the only practicable exit, Hoxa Sound, was narrow and extremely shallow. Furthermore, the wave and surf action in the passage must have put a great deal of noise into the water and this must have seemed like an impenetrable barrier to animals that sense their environment and 'feel' their way around using sound.

The nature of Scapa Flow changed radically after World War II, when barriers against incursion by enemy submarines were put in place and the movement of water between the islands was drastically reduced. As a result, the area is now impoverished in terms of marine life and certainly could not provide enough food for six hungry sperm whales. Add to this the risk that they might have been struck by one of the large ships (large tankers and ferries) that regularly pass through the area, or become disoriented by the shallow waters and become stranded, and it was clear that this was an unhealthy place for the animals. It was not, therefore, surprising that concern for their survival developed in the local, and wider, community as the animals remained day after day in the deepest parts of the Flow and showed little likelihood of discovering the route to the open sea.

When the whales had still not left the Flow after three weeks, Scottish Natural Heritage convened a meeting at which it was decided to try a novel method of luring the whales out of the Flow using recorded sperm whale vocalisations. If that failed, SMRU felt that a carefully coordinated shepherding operation using a large fleet of ships might succeed. Experience of working around sperm whales in various parts of the Atlantic using different types of vessel had demonstrated to us that this species moves away from engine noise. There was perhaps a chance that a carefully-coordinated drive of the type used by the Faroe Islanders in their pilot whale hunt might allow the trapped sperm whales to be guided away from the

Photo. by Orkney Photographic

Sperm whales in Scapa Flow.

Photo. by G.V. Mackie

Captain Britain (standing) handing over to Captain Williamson at the Liverpool Port Met. Office. (See page 88.)

Photo. by G.V. Mackie

Captain Mackie making the retirement presentation to Captain Coombs. (See page 89.)

danger rather than into it. Nevertheless, such an operation had never before been attempted on anything the size of sperm whales and there was always the danger that some or all of the animals might be driven aground. This really was a plan of last resort.

Unfortunately, bad weather prevented all but a rather hurried attempt at using the acoustic approach, but on 24 March it was decided that time was running out for the trapped whales and that Operation Gentle Shepherd (as it was dubbed by the Press) should be put into action on the following day.

Thursday 25 March dawned fine, with a gentle breeze. The whales were spotted soon after first light and, by 0930, a fleet of 17 vessels had been assembled in an arc around them. Two spotter aircraft alternated to provide continuous aerial reconnaissance. Waiting for a favourable tide at midday, the fleet first allowed the whales to settle, then gently nudged them towards Hoxa Sound, the only practicable exit. Coordinated by a SMRU scientist, and under the supervision of Captain Bob Moore of the Orkney Harbour Department, the fleet comprised a variety of craft ranging in size from three huge ocean-going tugs through various types of fishing boat to two of SMRU's own inflatable Zodiacs. The inflatables were used much as sheep dogs, reacting quickly to potential problems and turning the whales or bringing them back into the ring of boats if they strayed off course.

At the mouth of Hoxa Sound, when everything seemed to be going very smoothly, the whales stopped, milled around and then dived. After 20 minutes they surfaced, but two miles north of the fleet and back in the centre of the Flow. They had escaped by swimming underneath the ships. Dividing into two groups, the fleet turned at full speed and reformed on the far side of the whales, then shepherded them southwards at 4 knots. This time, they were kept moving with little opportunity to think and were pushed through the bottleneck at about 1430. One of the whales split away from the others, but later joined them again. The fleet maintained the pressure, using depth sounders and fish finders to create a wall of sound through which we hoped the whales would not swim. By dusk the group, now reunited, was clear of the islands and the six whales were last seen by the spotter plane heading westwards towards the open sea, safety and, appropriately enough, a fine sunset.

Although the circumstances were unique, we are confident that lessons learned in the chilly and windswept environment of Orkney will be of direct relevance to whale rescuers elsewhere in the World. The technique, though perhaps outwardly crude in that it sometimes relied on the sheer and often awesome power and speed of large ships, has been described by one observer as resembling a giant ballet, as the many vessels changed position and pirouetted in response to the whales' movements. In the end, its success was due to the ability to recognise, predict and react to sperm whale behaviour in circumstances that changed on a second-by-second basis. Many times we guessed wrongly, but we were correct often enough to get the job done, and we learned a great deal in the process.

And what of Science? To be honest, little in the strictest sense. We even passed up the opportunity of attaching to these animals the radio telemetry devices for which the SMRU is renowned and which would have told us where they went after we last saw them. Nevertheless this unexpected opportunity to apply the accumulated wisdom from years of field research on cetaceans to a purely humanitarian project seems to have been well received. Furthermore, to those of us lucky enough to have been out on the water that day, it brought a job satisfaction that can rarely have been bettered.

Meet the Port Met. Officers

In the final part of our series of articles about PMO operations around the coasts of the United Kingdom, we meet the two Port Met. Officers who were, up to the end of 1993, covering most of the east coast of England, although they themselves have since changed berths (see Retirements and Notices).

East England

When the Port Met. Office for Hull changed premises recently, the incumbent, Captain E.J. O'Sullivan, made certain that ships entering and leaving the Albert Dock would know exactly where he was based, putting up a large sign outside the office which could be seen by ships passing through the lock. Ably assisted by his Scientific Officer, Malcolm Taylor, Eddie O'Sullivan commands a PMO territory from Flamborough Head to the Wash. Ports visited for the servicing of VOF ships include not only the large Humber estuary ports of Hull, Immingham and Grimsby but the smaller upriver havens of Goole and Gunness. The PMO staff meet with ships' Masters and Officers from many countries during the course of their duties, providing observing ships with advice and stocks of meteorological instruments and stationery to assist them in their important co-operative work.

Crown Copyright

Captain E.J. O'Sullivan, former PMO, in Hull docks.

Captain O'Sullivan was born in January 1944 and educated in County Cork, Ireland; he took three months pre-sea training at T.S. *Vindicatrix*, Gloucester, at the end of which he made a round voyage from London to Brazil and return as a Boy Rating on Royal Mail Lines' *Brittany*. He gained his various Mates' Certificates whilst sailing with Blue Star and F.T. Everard ships and in April 1970 he joined Fyffes Lines and sailed in s.s. *Golfito*, gaining his First Mate's Certificate the following year. He later transferred to Whitco Marine Services,

which was merged with Salen UK, and obtained his Master's Certificate in November 1978. Whilst he was Chief Officer with Salen in 1980, he took part in the rescue of 180 Haitian refugees from a small boat off the Bahamas, landing them all safely at Miami. He was promoted to command his first ship, *Sijilmassa* (ex *Lapland*) in January 1983.

He then operated his own coastal vessel for three years, before being selected to join the METROUTE ship routeing team in the Met. Office in January 1988, where he served for three years. After another period of 18 months in self-employment, he rejoined the Marine Division as PMO Hull in June 1991.

Captain O'Sullivan lives with his wife Christine and two young sons in Slough, within easy motoring distance of his new post at Marine Division headquarters at Bracknell, where he relieved Captain Coombs after handing over his Hull office into the tender care of Captain Steel (see below) last December.

North-east England

At the time of writing, Captain J. Steel was the PMO based at Middlesbrough, covering the ports and havens on the coast between Flamborough Head and the Scottish borders. This of course includes his main areas of the Tees and the Tyne ports, where most of his ship visiting liaison work is carried out.

Crown Copyright

Captain J. Steel, former PMO Middlesbrough, now PMO Hull.

John Steel was born at Scarborough in October 1946 and started his apprenticeship with Andrew Weir & Company at the age of 16, when he went straight from secondary school to join m.v. *Oakbank* at Doxford's building yard in Sunderland in March 1963. After only two short periods of leave he completed his four-year apprenticeship in March 1967 and passed for Second Mate's four months later. He then enjoyed three years on Bank Line's U.K. to Australia and New Zealand service via the U.S.A., returning by way of New Guinea or the

Pacific Islands of the tropics. As if this idyllic existence was not enough, he met his wife Denise in Sydney during this period, and they now live with their two sons at Scarborough.

Captain Steel obtained his Master's Certificate in October 1973 and was appointed to command *Roybank* in early 1978. In six years he commanded ten different Bank Line ships before changing companies to Coe Metcalf Shipping and taking command of the Dynamic Positioning vessel *Pholas* in 1984, working mainly in the North Sea.

In 1987 he was appointed as Deputy Director of Maritime Affairs in the Bahamas Ministry of Transport Marine Division, working from the High Commission in London. After this involvement in all aspects of shipping administration he made an attempt to withdraw from the marine scene when he and his wife bought a small shop near his Scarborough home in 1988. After four years the pull of ships and shipping brought him back to join the Met. Office and the village shop was sold in preference for manning the PMO shop at Middlesbrough. Captain Steel was moved to man the Hull Port Met. Office in December, and by the time of publication we expect the Middlesbrough post to be filled by a new incumbent.

D-Day Anniversary, 6 June 1994

At the approach of the 50th Anniversary of the invasion of Nazi-occupied Europe, it is perhaps interesting to recall the great efforts which both sides made to obtain their badly-needed meteorological information from the oceans, and particularly for that critical period when the D-Day landings were planned. Past records and climatological information assumed immense importance in an endeavour to increase our scientific knowledge and to probe the mysteries of the future weather.

During the war, the Meteorological Office, whose headquarters was evacuated from London to Stonehouse in Gloucestershire, kept in touch with the Voluntary Observing Fleet as far as possible through its one permanent Port Met. Officer at Liverpool and the Merchant Navy Agents at other ports. When D-Day finally dawned on 6 June 1944, after the postponements caused by the forecasts of bad weather, culminating in the miracle of the prediction of the fine weather window, 7,000 ships of all sizes and types sailed to the Normandy beachheads. Aside from naval vessels and landing craft, the fleet of Operation Neptune, as it was named, included 864 merchant ships and 736 auxiliary ships, as well as a number of smaller craft — British and Commonwealth, U.S., Dutch, French, Norwegian and Polish. The operation involved five percent of the British merchant fleet, with two-thirds of the merchant ships being British and many of those members of the VOF. More coasters than ocean-going ships were used because of their greater ability to sail close inshore and to be beached.

In his Christmas Day message of 1944, King George VI spoke thus of the Normandy landings, 'The greatest combined operation the world has ever seen, perhaps the greatest it will ever see. The three fighting Services and the Merchant Navy worked as one vast complex, but perfectly constructed machine and won a resounding victory. When volunteers were asked for D-Day, pretty well all the seamen in the United Kingdom must it seemed have volunteered.'

The VOF was depleted by enemy action from 360 Selected and 635 Supplementary Ships in 1939 to 272 Selected and 208 Supplementary ships in 1945, and it was thus possible, very soon after the termination of hostilities, for these ships to resume voluntary meteorological work at sea. Those who laid down their lives in defence of their country in that conflict, including those who perished in the battle for France, begun on D-Day, are remembered at this time. We owe a particular debt to those members of the pre-war Corps of Voluntary Marine Observers who died in the struggle.

SPECIAL LONG-SERVICE AWARDS

Once again the Chief Executive has pleasure in selecting four shipmasters for receipt of inscribed long-service barographs, for their voluntary observing service up to the end of the year 1992, as follows:

CAPTAIN T.R. BARTON, Furness Withy (Shipping) Ltd.
CAPTAIN D.L. BATCHELOR, P&O Containers Ltd
CAPTAIN R.K. BILTON, Blue Star Ship Management Ltd.
CAPTAIN B.A. CHAPMAN, Ministry of Agriculture and Fisheries.

To qualify for selection, nominees must have submitted a meteorological logbook during the year in question and have undertaken voluntary observations in 18 separate years. The awards are made in recognition of long and excellent service in the cause of voluntary marine observing for the United Kingdom.

Captain Barton first sent in a meteorological logbook from Shaw Savill's *Athenic*, received at the Met. Office in July 1957. He sent in a total of 53 logs, including 21 marked 'excellent' in 24 observing years: he also received an Excellent Award book in 1979.

Captain Batchelor's first log reached the Marine Division from Henderson's *Pegu* in February 1966, since when he has submitted 52 more logs, 29 of which were assessed as 'excellent'. He served a number of years with Alfred Holt's Blue Funnel Line before transferring to Containers Fleets in the mid-1970s.

Captain Bilton's first logbook came from Blue Star's *Paraguay Star* in November 1956. In 27 observing years with the Blue Star company he has helped to compile 66 logs, 20 of which were marked 'excellent'. He received Excellent Awards on six occasions.

Captain Chapman started his weather observing in Bristol City Line's *Toronto City*, sending in the first of 56 logs in January 1962. Seeing service in Natural Environment Research Council vessels as well as in MAFF's fishery research ships, he has received twelve books as rewards for achieving 'excellent' markings for 34 of his logs.

It is hoped that the Chief Executive will be able to present inscribed barographs in the summer months, when we will do our best to bring all four Masters together at Bracknell for the ceremony. These presentations were introduced by the Director of the Met. Office in 1948 and have been held annually since that time.

AURORA NOTES APRIL TO JUNE 1993

By R.J. Livesey

(Director of the Aurora Section of the British Astronomical Association)

In Table 1 are listed the marine observations of the aurora received to date for the period. Notwithstanding the lack of reports there was a strong magnetic storm on 4/5 April when land observers reported coronal and overhead aurora along the Moray Firth and also in North Dakota. The magnetic field remained generally disturbed until 24 April with associated apparitions of mid-latitude aurora during stormy periods. There was a period of magnetic quiet on 27 and 28 April to be repeated with solar rotations on 21–26 May and 16–22 June. Upsurges of magnetic activity on 30 April, 27 May and 23 June were associated with minor mid-latitude auroral sightings. Magnetic storms and auroral events were experienced on 8–10 May and 4–5 June.

Table 1 — Marine aurora observations April to June 1993

Date	Ship	Geographic Position	Time (UTC)	Forms in Sequence
7/8 May	*Cumulus*	56° 42′N, 22° 06′W	0145–0310	$aR_1A.a_2fR_2a_1A$. Max. alt. 60°.
9/10	*Cumulus*	57° 06′N, 20° 48′W	0100–0300	$a_1p_1R_3B.a_1p_2R_1BqHA$.

KEY: a = active, a_1 = folding of bands, a_2 = rapid change of lower form, f = fragmentary, p_1 = flaming upwards, p_2 = flickering, q = quiet, A = arc, B = band, H = homogeneous, R_1 = short ray, R_2 = long ray.

The sunspots have quietened down and, as expected in the decline of the sunspot cycle, the coronal 'holes' are much in evidence. These zones of open magnetic field lines in the outer atmosphere permit charged particles to escape from the sun and spray the Earth as the sun rotates. Generally they produce relatively quiet mid-latitude auroral forms such as glows, arcs and some rays. However, on occasion it has been noted that stronger magnetic storms with more spectacular aurora can occur when, it is thought, coronal holes and not transient events such as solar flares or mass ejections from the corona itself occur.

The end of May saw the opening of the Northern Hemisphere noctilucent cloud (NLC) season. The frequency and extent of NLC was not as high as in some earlier years but there was a big apparition on 24/25 June which was well observed down to the English Channel, the date being very close to the summer solstice. These clouds are thought to require a low temperature of $-165°$ at their altitude of 82 km, or thereby, to enable water molecules to crystallize on to a nucleus such as meteoric dust or other particles in the high atmosphere over the polar region where the temperature is low in summer and high in winter.

An inspection was made of confirmed NLC events collected by Dr David Gavine, for the period 1986–1992 and published in the *Meteorological Magazine*. In Figure 1 is shown the frequency with which the observer at the lowest geographic latitude sees NLC. The results are subjective and dependent not only on the southerly extent of the events but also on the locations of observers and their weather conditions. In Figure 2 is given the frequency with which NLC has been seen on a given date from which it will be noted that it is most probable that

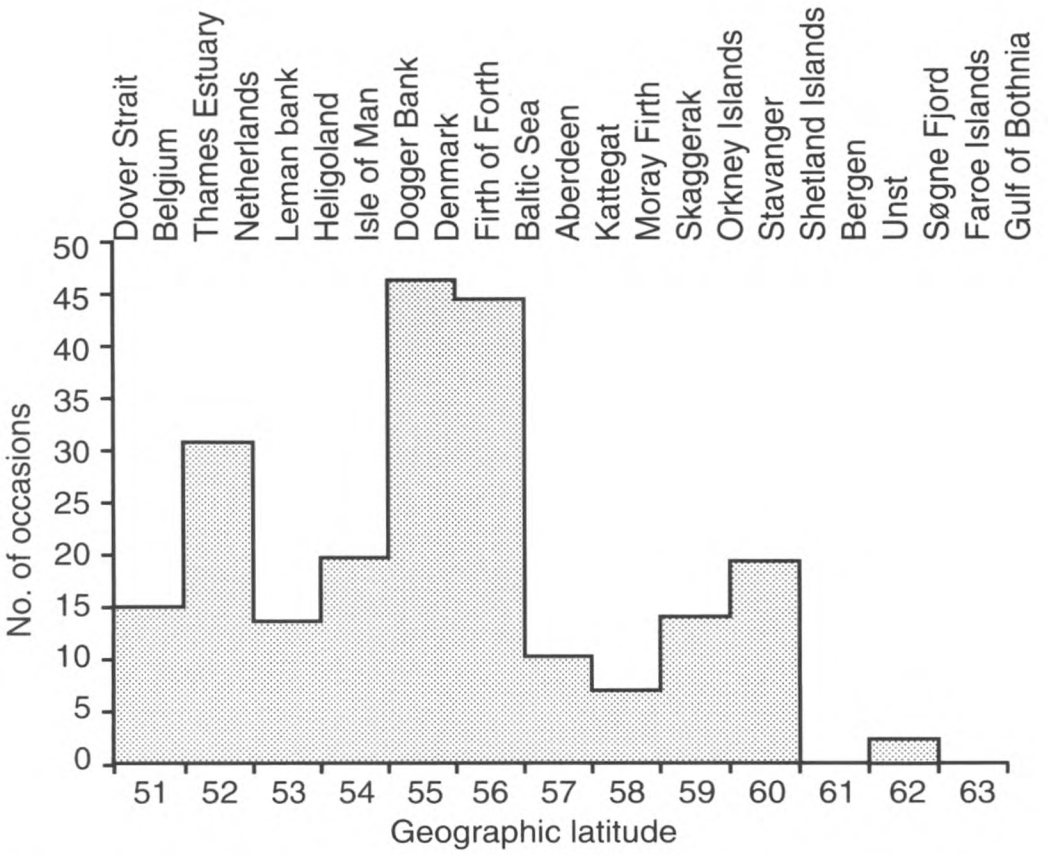

Figure 1. Location of most southerly observer seeing NLC and number of observations. 1986–1992.

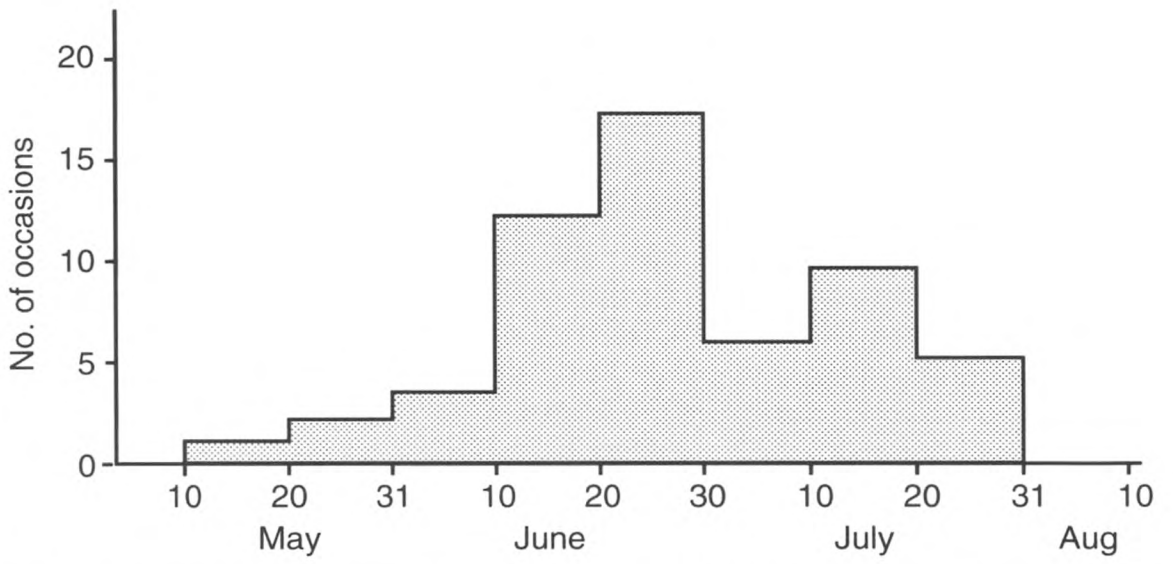

Figure 2. Frequency of NLC seen from geographic latitude 52°N or southward in western Europe. 1986–1992.

an event will be observed close to the summer solstice. This should encourage observers who have not seen NLC to look for it at this time of year. Many observers on 24/25 June saw and photographed their first NLC event, some not knowing what they saw. The writer recalls climbing Ben Lomond one year, on midsummer's night, with one of his daughters, and making use of the reflected light of the NLC to detect pools of water lying on the darkened pathway. The view at sunrise was worth the effort.

On the night of 30 June/1 July simultaneous NLC and an auroral arc were photographed from North Dakota. Expert interpretation of the photographs, by Dr Gadsden, of Aberdeen University suggests that NLC were not present but rather the apparition stemmed from the trails of high-altitude sounding rockets probably fired from Fort Churchill, on the west side of Hudson Bay. Over the years a number of simultaneous sightings of NLC and aurora have been made but not all have been photographed for interpretation. Auroral activity above an altitude of generally 100 km heats the upper atmosphere owing to the kinetic energy of incoming particles and the larger electrical currents circulating in the ionosphere owing to the greater conductivity resulting from the aurora. Yet it would appear that on occasion the lower level at 82 km is cold enough to allow the NLC to form. There are records where NLC has formed and faded as the aurora develops, to reappear as the aurora in turn disappears. There are as yet many unknowns related to the NLC, and any observations made of this phenomenon, particularly when in simultaneous occurrence with the aurora, will be very welcome.

There are observing groups for aurora and NLC in Estonia and Finland; the Finns in particular observe exhaust emissions from Russian rockets. The pattern that these emissions take are different from those associated with NLC and given a photograph or detailed drawing of the cloud pattern it is possible to determine whether rockets or NLC are involved.

There is another upper atmosphere phenomenon that can look aurora-like. From to time research rockets are used to inject barium, lithium and europium, for example, into the upper atmosphere. If in sunlight but the observer is in the shadow of the Earth the barium ionises quickly and reacts with the magnetic and electric fields present. The observer sees initially a circular cloud similar in size to the full moon but which then spreads out to form long, band-like structures. The bands may contain streaks of light parallel with the magnetic field and can look like striated red auroral forms. On the other hand, lithium ionises but slowly and the moon-like cloud drifts slowly with the non-ionised or neutral particle winds. Scientists use the comparison between the behaviour of the two clouds to measure the properties of the high atmosphere. As yet there are unconfirmed reports that an apparition resembling a rocket probe emission was seen by observers on the west coast of Denmark on 20 October, 1993, early in the morning. Aurora was reported only as a quiet glow north of Fair Isle. Any observations from ships relating to sky phenomena on that night would be very welcome.

LETTERS TO THE EDITOR

I recently completed a voyage as one of the meteorologists in the Ocean Weather Ship *Cumulus* (Captain Peter Hunter, Chief Officer David Shaw), sailing from Greenock on 27 April, 1993, taking up station at 57°N, 20°W, and returning to Milford Haven on 31 May. The voyage was noteworthy for the unusual amount of cetacean activity in the area. Pilot Whales up to 6 m long and sometimes in groups of 40 to 50 were sighted close to the ship on the 6th, 9th-11th, 14th, 17th, 20th and 24th May. A Sperm Whale approximately 15 m long circled the ship on the 22nd,

while on the 23rd, about 50 Common Dolphins intermixed with a few Pilot Whales were observed passing the ship. The photograph shows 'Pilots' at 1200 UTC on 6 May, in position 56° 34′N, 22° 27′W when the weather conditions were as follows: air temperature 8.2°, sea temperature 9.1°, wind variable WNW'ly, and the cloud cover was 7 oktas thin stratocumulus. Swells were present at 290° and 200° and the heights were 2.5 m and 1.5 m respectively.

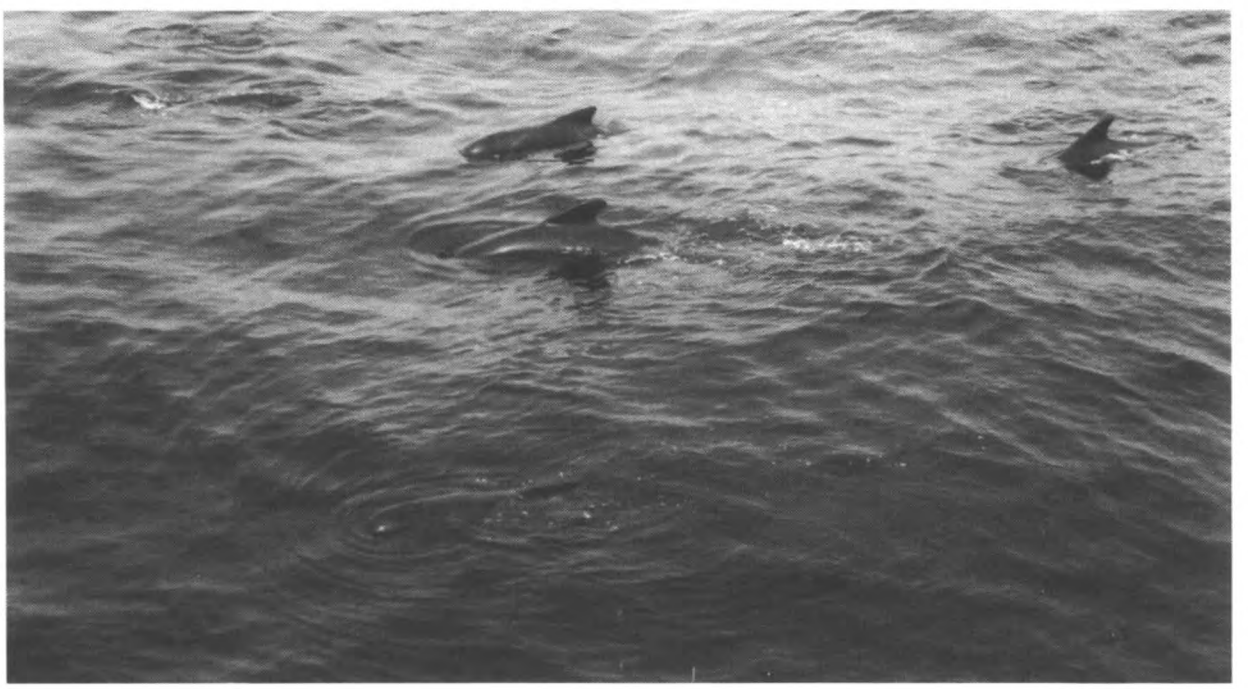

Photo. by H.R. James

Apart from a daily diet of Kittiwakes, Fulmars, Great Black-backed and Common Gulls, many other sea and land birds were observed. These included Great Skuas, Arctic Skuas, Long-tailed Skuas, Gannets, Great Shearwaters, Manx Shearwaters, Guillemots, Sanderlings, Dunlins, a Swallow, a House Martin, a Whimbrel, a Wheatear and possible sightings of a Merlin and Reed Warbler. Off the Pembrokeshire coast Common Terns, Atlantic Puffins and storm petrels were also seen.

Mr H.R. James, Penryn, Cornwall.

Book Reviews

Annular Solar Eclipse May 1994 — An Observer's Guide by Sean Clarke and Sheridan Williams. A4 booklet, 24 pp. Obtainable from Sheridan Williams, The Clock Tower, Stockgrove Park, Leighton Buzzard, Bedfordshire LU7 0BG. Price: £5.00.

Sean Clarke, a Scientific Officer working in the Product and Services Provision Branch of the Met. Office, has collaborated with Sheridan Williams to publish the first in their series of guides which they intend producing for each forthcoming Total and Annular Solar Eclipse. This guide concerns the Annular Eclipse of Tuesday 10 May 1994, which, however is not a particularly good one for viewing the 'Ring of Fire' which is produced when the 99% of the Sun is blackened out by

the Moon, leaving a ring of light around the blackened core. This annular eclipse is comparatively disappointing because the Moon is too far from the Earth to appear large enough to cover much more than 85% of the Sun. As a result the amount of Sun visible will dazzle the observer.

The authors explain that what makes this annular eclipse of particular interest to viewers in the Northern Hemisphere is that its track passes over the eastern Pacific Ocean, Mexico, the U.S.A., south-eastern Canada, and the mid-Atlantic region including the Azores and Morocco. Viewers in the United Kingdom will only see a partial eclipse, maximum coverage of the sun varying from 60% in Cornwall between 1734 and 1954 UTC, to 40% in the Shetland Isles between 1825 and 2021 UTC.

This condensed guide contains far more information then bare statistics about the May 1994 Annular Eclipse. There is an introductory section which gives a table of forthcoming eclipses, including the Total Eclipse of August 1999, visible from parts of Cornwall and the Channel Islands; there are maps, astronomical statisitics, meterological tables showing eclipse tracks, climates and cloud cover probabilities during the eclipse. There is a very comprehensive guide to eclipses past and expected, in addition to the detailed text about the May event. There is also guidance as to where further information can be obtained.

The authors are at great pains to remind observers to exercise extreme caution when viewing the Sun. Failure to observe through suitably dark material can result in damaged sight or blindness. Navigators will be aware that sextant sun shades are usually suitable, provided one starts with the darkest combination possible, gradually lightening until a comfortable level is found.

This is a very useful guide for those interested in eclipses, and certainly a valuable aid to viewing this event. Perhaps in their future publications, with experience the authors may settle on a less haphazard layout, rather than having historical factors interspersed with pages dealing with the current event, equally in text paragraphs, maps and tables.

J.F.T.H.

Bridge Team Management by Captain A.J. Swift, MNI. A4 paperback, 80 pp. The Nautical Institute, 202 Lambeth Road, London SE1 7LQ. Price: £15.00 to Nautical Institute Members, £21.43 Non-members, Airmail £6.00 extra.

This is one of the many respected publications produced by the Nautical Institute in recent years, and follows in the line of practical guides to the seafaring community. This book aims to respond to the question 'Is there a need for a well-defined bridge organisation?', and does so most thoroughly by bringing together in one book for the first time, all the elements needed to understand and define standards of a ship's bridge operations. Following an introduction by the Secretary-General of the IMO, pointing out the close connection between IMO principles and those to which this publication aspires, and a foreword by the Nautical Institute President, eight chapters and two annexes cover all aspects of the subject.

The book is clearly intended for the mature student nearing the time for sitting for the First Mate's or Master's examinations, although much of the basic teaching on chartwork and navigation should have been acquired earlier. Much of the content will be equally useful to seafarers from other lands whose requirements, although approximately similar, may not be to the same standards as his or her U.K. counterparts. The presentation and prose has a certain classroom feeling

about it with little attempt at practical examples to illustrate the chapters on navigation methods and passage planning in a more lively fashion.

Relationships with pilots and bridge automation is very well covered, and it is useful that the IMO STCW Convention of 1978, on basic principles in keeping a navigational watch, has been included as an annex.

J.F.T.H.

Woman of Steel by Vivien Cherry with Keith Wheatley. 155 mm × 235 mm, 184 pp. Adlard Coles Nautical, an imprint of A&C Black (Publishers) Ltd, 35 Bedford Row, London WC1R 4JH. Price: £9.99, paperback.

Having followed the fortunes and tribulations of the whole British Steel Challenge fleet during the round-the-world yacht race, and the *Coopers and Lybrand* more closely than most of the others, Vivien Cherry's book had been eagerly awaited in the Marine Division. The book turned out to be a well illustrated affair and easy to read from the standpoint of even a non-sailing person. Vivien Cherry is clearly a lady of very high calibre, and certainly achieved the aim with which she had started out, four years before she finally brought her yacht home to high acclaim, in fourth place overall after 155 days of sailing around the globe. How many women do we know who have sailed around the Horn, albeit in comparatively fine weather, only to be afflicted a few days later with a smashed forestay in force 10 winds and freezing temperatures? The saga of the infamous rigging screws is now well documented, but all the detail of the event and subsequent makeshift repairs make for interesting reading in this book. There is even a step-by-step guide to rigging a jury forestay.

There are unfortunately not many other thrills recounted in this book, which although full of interesting detail, does not achieve a sensation of the fearsome adventure and frustrations that must have beset the author and her crew. Although the sponsors' support for all the yachts was clearly vital to the success of the whole race, it is a pity that publicity and media considerations had to detract from the opportunity of producing a more vivid and thrilling account of the lady's unique achievements.

J.F.T.H.

Personalities

RETIREMENT — Captain M.J.R. Godbehear has retired after an auspicious career lasting almost 42 years at sea.

Michael John Ross Godbehear was born on 25 July 1934 in Walthamstow, the youngest of three boys and three girls of an Army Officer. After receiving his education at Rushmore House School, Kidderminster and King Charles I Grammar School, he broke with the family Army tradition and signed indentures with Alfred Holt & Company in November 1951, being paid £390 over four years in annual instalments of £75, £90, £105 and £120.

His first two voyages to sea were made as Deck Boy and Ordinary Seaman in the German four-masted barque *Passat*, sailing between Germany and South America. The ship carried cargoes of bagged cement outwards and returned with grain in bulk. The first Blue Funnel ship he joined as Midshipman was *Atreus*, followed by several other Blue Funnel and Glen Line ships. He qualified for Second Mate in 1956 and returned to sea on *Peleus* during the first Suez crisis.

His first meteorological logbook, one of a total of 59 in 25 years of observing, and his first of 37 out of those to gain an 'excellent' marking, was received from his ship *Hector* in October 1959. For this initial effort he was nominated for the first of six Excellent Awards during his observing career. After passing for Master's Certificate in 1962 he was promoted to First Mate in May 1967, sailing in *Tantalus* to the Far East and then on Round-the-World Services. In December 1974 he transferred to Container Fleets, first in *Tokyo Bay* and later in all the *Liverpool Bay* class vessels. After spending a year with Trio Planners, co-ordinating the loading of container ships, he returned to sea as Mate on *Tokyo Bay* in November 1982 when the ships transferred to Overseas Containers Ltd.

He was promoted Master in December 1984 in *Mosel Express* (*Falmouth Bay*). Whilst Master of *Tor Bay* in the late 1980s, his ship was boarded by pirates north of the Horsburgh Light, east of Singapore Strait, whilst sailing towards Japan, and he was bound hand and foot. Captain Godbehear's typically phlegmatic comment was, 'Luckily no physical damage was done but nonetheless not an experience I wish to undergo again.' Perhaps it was some consolation to be invited to Bracknell four years later, to receive a long-service award barograph from the Director General for outstanding service in marine weather observing over 19 years to that time. He was Master of *Tokyo Bay* from March 1988 until he left the ship on 1 June for official retirement on 31 July 1993.

Captain Godbehear sums up thus: 'I think that life on a working, cargo-carrying, sailing ship is a far cry from life on a modern diesel-powered container ship. I can honestly say that during my career at sea I have seen a great change in the way cargo is transported and handled around the World. As to plans for the future, having spent so much time sailing to the Far East I may perhaps visit China and see some of the interior and not just the edges.'

We wish Captain Godbehear the very best in retirement and reiterate his own desire, that he should draw his pension for as long as possible.

RETIREMENT — CAPTAIN R.C. CAMERON retired as Deputy Marine Superintendent in October 1993.

Robert Cameron was born in Shanghai in November 1932, educated at George Watson Boy's College and Morison's Academy and trained on H.M.S. *Conway* between 1947 and 1949. He joined his first Blue Star Line ship *Trojan Star* in April 1950 and obtained his Master's Certificate in January 1959. The first of 17 meteorological logbooks he sent in came from *Empire Star* in April 1953 and the last from the one ship of which he was Master, for eight months, *Imperial Star*, in March 1969.

He left Blue Star Line in April 1969 for studies and joined the Met. Office in August 1970, sailing from Greenock on OWS *Weather Monitor*. He joined the Ship Routeing Team in the Central Forecasting Office at Bracknell in May 1973 and transferred to the Port Met. Office, South-east England, in July 1975. He was promoted to Deputy Marine Superintendent in September 1983.

RETIREMENT — CAPTAIN A. BRITAIN retired from his position as Port Met. Officer for North-west England on 27 December 1993 after 14 years with the Met. Office and a total of 45 years serving the marine industry.

Albert Britain was born in December 1930 and served his time with the Medomsley Steam Shipping Company. In November 1951 he joined the New

Zealand Shipping Company as Fourth Officer, remaining with the company through various ranks to attain command before becoming Marine Inspector and later Assistant Marine Manager, P&O General Cargo Division, in 1974. He had sailed in refrigerated and car carrying vessels, and sent the first of a total of 22 meteorological logbooks to the Office from the *Somerset* in October 1953. Of these logs, 21 were marked 'excellent', and he received Excellent Awards on four occasions, the last in his final year in command.

When he was Chief Officer of the *Remuera* in February 1964, bound from London to New Zealand with a complement of migrants and holidaymakers, Captain Britain was highly praised for his organization in evacuating many of the 2,000 inhabitants of the earthquake-stricken island of São Jorge in the Azores. He was sent ashore by *Remuera*'s Master, Captain R.G. Hollingdale, to take charge of the ferrying by the ship's diesel-powered lifeboats of 360 evacuees from the port of Calheta. The boats' crews worked from about 1500 to 0100 the following morning, only to have to resume the operation of landing the islanders at Terceira, 50 miles away, soon afterwards. The incident was chronicled in the *New Zealand Herald* after the ship's arrival there the following month.

On joining the Met. Office, Captain Britain was appointed to Ocean Weather Ship *Admiral Beaufort* and was promoted to Master shortly afterwards. After three years he was made Ocean Weather Ship Officer when the single remaining OWS in service was based successively at Greenock, Fleetwood and back to Greenock again. During this time he was also PMO at Hull from 1982 until his promotion to the Liverpool Port Met. Office in 1989, where he remained until his retirement in which we wish him good fortune and success in his many activities and hobbies which will no doubt keep him busy enough. Further details of Captain Britain's career were published in the October 1993 edition of *The Marine Observer*.

RETIREMENT — CAPTAIN M.L.McN. COOMBS retired from the Marine Division at Bracknell Headquarters on 24 December 1993 after ten years with the Met. Office, following a sea career lasting 37 years.

Michael Coombs was born in London on 8 October 1928 and educated at St John's School, Leatherhead. Following pre-sea training at King Edward VII Nautical School, he was apprenticed to Port Line Ltd and one of his earliest experiences was service on a coal burner, s.s. *Port Campbell*. After obtaining his Second Mate's Certificate in 1950 he rejoined Port Line and remained with that company for the rest of his seagoing career. The only two affiliated but non-Port Line ships he served on were *Montreal Star* in drydock in London and Brocklebank's *Manipur* to Red Sea ports.

Captain Coombs obtained his Master's Certificate in 1956 and was given his first command in 1963 on *Port Fairy*, a twin-screw motor ship that was built two years before he was born. In 1982 he left the sea after 19 years as Captain of Port Line ships, the last one being m.v. *Masirah* (ex *Port Alfred*), on the Brazil to Persian Gulf run with frozen chickens.

His first meteorological logbook was sent from the *Port Napier* in October 1951, and during his 22 observing years, Captain Coombs submitted 37 logs containing his name, 20 of these being assessed as 'excellent'. For his efforts he received four Excellent Awards and, in his final year at sea, he was short-listed for a long-service barograph award although not quite making the top four.

Captain Coombs applied for the position in the Met. Office shortly after coming ashore, but another year passed before he was selected. Luckily for the Marine Division, such was his confidence that he remained a Nautical-Officer-in-waiting for twelve months, and he has stayed as a Nautical Officer up to his retirement. When he joined the Office in December 1983 with responsibility for Port Met. Officer liaison and shared duties of assessing ships' meteorological logbooks after receipt and quality control, he inherited an organization which included seven PMOs in the main U.K. ports, and a number of overseas PMOs holding small stocks of stationery and instruments for issue to U.K. VOF ships.

He leaves with a much larger field of co-operation in place, in this work of international importance, having built up many new contacts around the world. Fortunately for us, these PMOs overseas have been only too willing to undertake mutually beneficial observing ship visits, for the purpose of replenishing ships' stocks. Perhaps Captain Coombs' most satisfying moments came in his final year, when he was able to meet many of his contacts from afar who, until the convening of the International Port Met. Officers' Seminar in London in September 1993, had merely been voices on the telephone. As a result of his personal approach, he was able to persuade at least four new PMOs to become VOF equipment or stationery holders, besides making an impact with the other delegates at the conference.

As we wish him the very best in all his retirement ambitions, we leave Captain Coombs to have the last word, with a marine anecdote and a valediction. 'When I started work in the Met. Office, I was surprised to find that an old friend from my New Zealand sailing days with Port Line, Captain Arthur Borthwick, was already working for the Office in the ship routeing section, METROUTE. This reunion prompted memories of the last time we met when we were both in our commands in the port of Napier, Captain Borthwick being Captain of his Shaw Savill ship. One night just before Christmas, the port experienced a very bad storm which caught everyone by surprise. The storm tracked its usual course around the north of New Zealand, only to suddenly change its direction westwards and pass over the port. The heavy swell that the storm produced did not break over the breakwater but both our ships started to break adrift. On my own ship, the movement caused the gangway to break from its platform, causing a shore bollard to be pulled out of its moorings, nearly killing the visiting Harbour Master. We both left the port and anchored under the lee of the nearby Mahia Peninsula for three days, only returning to port in time for Christmas Eve, to find the port and ourselves none the worse for wear.

'During the past ten years in this post, I have been lucky enough to be associated with many friends in both the sea-going and shore-based shipping fraternity, as well as Port Met. Officers around the World. I would like to take this opportunity to thank everyone for all the help and co-operation given in this field of work. For me it has been a very pleasant and satisfying experience and I wish my successor, Captain Eddie O'Sullivan, all the very best.

'I shall be staying in my home in Surrey with my wife, Pat, and expect to continue to be fully occupied with DIY for myself and my two sons and daughters-in-law, dog-walking and being entertained by our four grandchildren.'

He also appears to wish to be reminded of the sounds of the sea, as he is continuing to learn the intricacies of campanology and was also presented by his many Office colleagues with a brass clock striking the bells of the ship's watches. (See photograph on page 76.)

Notices to Marine Observers

CHANGES TO SHIP CODE

The Commission for Basic Systems of WMO has approved certain modifications to various codes, including some to SHIP code FM 13-IX Ext. SHIP, for introduction on 2 November 1994.

(a) The addition of a group for reporting wet-bulb temperature.

(b) The mandatory reporting of all present weather, past weather, cloud and wave groups.

(c) The indication for type of measurement of sea surface temperature.

The following modifications to code groups will be made:

(i) Replace $0s_nT_wT_wT_w$ by $0s_sT_wT_wT_w$.

(ii) Add a new group 23 in the *Ship's Meteorological Logbook*, $(8s_wT_bT_bT_b)$, inserted between group 22 and existing group 23, ICE etc., which is renumbered group 24.

The following specifications of symbolic letters will be added:

(i)	s_s	Indicator for sign and type of measurement of sea surface temperature.
(ii)	s_w	Indicator for the sign and type of wet bulb temperature reported.
(iii)	$T_bT_bT_b$	Wet-bulb temperature, in tenths of a degree Celsius, its sign being given by s_w.

The following code tables will be added:

s_s — Indicator for sign and type of measurement of sea surface temperature

Code figure	Sign	Type of measurement
0	positive or 0	intake
1	negative	intake
2	positive or 0	bucket
3	negative	bucket
4	positive or 0	hull contact sensor (i.e. Met. Office supplied)
5	negative	hull contact sensor
6	positive or 0	other
7	negative	other

s_w — indicator for the sign and type of wet-bulb temperature reported

0	positive or zero measured wet-bulb temperature
1	negative measured wet-bulb temperature
2	iced bulb measured wet-bulb temperature
3–4	not used
5	positive or zero computed wet-bulb temperature
6	negative computed wet-bulb temperature
7	iced bulb computed wet-bulb temperature

USE OF SHIP EARTH STATION STANDARD-C AND CODE 41

Following reports from ships' staff who have been experiencing difficulty in clearing their meteorological messages via the INMARSAT Standard-C system using code 41, the Marine Superintendent has obtained the following step-by-step guide from BT Customer Services. It is easier to follow with the screens in front of you:

Type in message text		
Key	**ESC**	to select options bar
	T	to select Transmit
	Space Bar	to call up menu
	N	to set up new address
Type	**???** ↵	the name you wish to call this address
Use	**arrow keys**	to highlight 'Special'
	Space Bar	to select
Use	**arrow keys**	to highlight 'Special Access Code'
Type	**41** ↵	
Use	**arrow keys**	to highlight **<OK>**
	↵	to select
	S	to select the address you have just created

Then follow usual procedures for selecting earth station and sending.

PMO REORGANIZATION IN THE NETHERLANDS

The Royal Netherlands Meteorological Institute (KNMI) has put into effect a number of reorganization plans.

Amongst these changes, the services of the PMO at Rotterdam were withdrawn on 1 February 1994 and ships in Dutch and Belgian ports will now be visited by KNMI staff from their inland headquarters at De Bilt. Mr George E. Venendaal, Head of KNMI's Bureau of Marine Affairs, first announced these proposals at the International Port Met. Officers' Seminar in London last September. He regrets any inconvenience these changes may cause, and assures us that Mr Schaap and his staff will continue to provide service and assistance to voluntary observing ships whenever possible.

PMO activities are now co-ordinated by Mr John W. Schaap, KNMI, P.O. Box 201, 3730 AE De Bilt. Telephone: (31) 30 206 391. Facsimile: (31) 30 210 849.

CHANGE OF ADDRESS — PMO HONG KONG

On 21 June 1993 the Port Met. Officer in Hong Kong moved from the Royal Observatory in Nathan Road to the following address:

Mr S.F. IP, Port Met. Officer
Royal Observatory Ocean Centre Office
14/F, Ocean Centre
5 Canton Road, Tsim Sha Tsui
Kowloon, Hong Kong

Telephone: (852) 732 9263
Facsimile: (852) 375 7555

The PMO can be contacted by U.K. voluntary observing ships in need of advice or replacement instruments and stationary.

METEOROLOGICAL MAGAZINE CEASES PUBLICATION

The Meteorological Office Board decided that publication of the *Meteorological Magazine* should cease with the issue for December 1993; as a result, the final issue was a bumper one of over 40 pages celebrating the magazine's contribution to the development and dissemination of meteorological knowledge, and contained a selection of highlights from 1866 to recent times.

The first edition of the *Meteorological Magazine* was published in 1920 by HMSO. It replaced *Symons's Meteorological Magazine*, which started in 1866. This decision therefore brings to an end an almost continuous publishing record of 129 years (publication was suspended during World War II). Legal obligations accepted when *Symons's Meteorological Magazine* was adopted are fulfilled by the continuing production of the Met. Office publications *Monthly Weather Report* and *Rainfall 19XX*, as well as certain internal publications confined to the Office.

The publication of a new international and European quarterly journal by the Royal Meteorological Society, called *Meteorological Applications*, is expected to provide a suitable vehicle for the kind of articles that formerly appeared in *Meteorological Magazine*, namely on research, practice, measurements, reviews, applications of meteorology, book reviews and the like.

MARITIME INFORMATION ASSOCIATION

Following receipt of a copy of a recent newsletter from the Maritime Information Association, we provide a precis of its contents, believing it to be of interest to sections of our readership.

The Association was formed, as the Marine Librarians Association, in 1971. Its objectives are to promote contact and co-operation between Librarians and Information Workers and others working or having an interest in the maritime world, as well as developing a body of professional expertise relevant to the literature and information sources in maritime activities.

Membership is on an individual basis and includes Librarians, Information Officers and all those having major or minor interests in subjects ranging over the

broadest interpretation of maritime topics. The Association's annual conference is normally held in April and in recent years has been staged in a variety of venues in major British or Northern European cities. The conference includes lectures by speakers from many sections of the marine industry, talking of many aspects of nautical interest, including but not exclusive to, library and information services. Visits to places and vessels of interest are also arranged where possible.

Applications for Membership of the Association can be sent to Mr Steven Rabson, Secretary, MIA, c/o P&O S.N.Co, 79 Pall Mall, London SW1Y 5EJ. The subscription is £10.00, with concessionary rates available for the unemployed and part-time workers.

The Association publishes a newsletter about four times a year, depending upon the level of members' contributions, and a List of Members. *Maritime Information: a guide to libraries and sources of information in the United Kingdom*, is now due for publication at £25.00, and can be obtained from the joint author, R.V. Bryon, c/o Library, National Maritime Museum, Greenwich, London SE10 9NF.

The Chairman, Honorary Secretary or Treasurer can be contacted by writing c/o The Marine Society, 202 Lambeth Road, London SE1 7JW.

STAFF CHANGES IN THE MARINE DIVISION OF THE METEOROLOGICAL OFFICE

Several members of staff of the Observations (Marine) Branch of the Met. Office were relocated in the last quarter of 1993, as follows.

On the retirement of CAPTAIN R.C. CAMERON after 23 years in Ocean Weather Ships, Ship Routeing, PMO London area and Deputy Marine Superintendent, CAPTAIN S.M. NORWELL has been appointed in his place. As PMO for Scotland and Northern Ireland until October, Captain Norwell's career was highlighted in the July 1993 edition of this journal. After training on H.M.S. *Conway* and serving his time with Donaldson Line, he joined the Met. Office and was appointed to Ocean Weather Ships in 1959. Apart from a year spent gaining deep sea qualifying time for taking his Certificates of Competency, he has been with the Office as Master of Ocean Weather Ships, in command of the OWS base at Greenock and PMO at Glasgow, and later, Greenock since then.

CAPTAIN J.A. WILLIAMSON moved from METROUTE, where he was the most senior member of the Met. Office's ship routeing team, to become PMO Liverpool on the retirement of CAPTAIN A. BRITAIN (q.v.) in December. At the same time, the senior grade post was transferred from the Liverpool PMO to CAPTAIN A.F. ASHTON at PMO Cardiff. Jim Williamson (see photograph on page 95) joined METROUTE in November 1986, having sailed with Manchester Liners from Apprentice to Master during his 27 years at sea, followed by four years as Container Terminal Superintendent for the company at Manchester and Liverpool. The first of 28 meteorological logbooks in which he played a part came from

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Captain J.A. Williamson, PMO Liverpool.

Manchester Shipper in November 1954. He is no doubt relieved to be able to commute direct to his office from his home in Preston, Lancs, once more. CAPTAIN A.P. MAYTHAM, Ship Routeing and specialist Sea Ice Officer, who joined the Office in 1988, is now the leading METROUTE staff member. Early in the year CAPTAIN D.J. HEWITT, who joined the METROUTE team in April 1989, moved to take up the new post of Market Sector Manager for Sea Transport in the Commercial Services Division.

CAPTAIN E.J. O'SULLIVAN moves from PMO Hull to Marine Division Headquarters in Scott Building, on the retirement of CAPTAIN M.L.McN. COOMBS (q.v.) as the Nautical Officer responsible for U.K. and International Port Met. Officer liaison, in the management of observational matters on VOF ships. Eddie O'Sullivan joined the Met. Office as a ship routeing officer six years ago after serving 24 years with several liner companies. He provided seven logs from Fyffes and Salen ships, whilst also collecting weather data on board voluntary observing ships on behalf of other countries.

CAPTAIN J. STEEL has been transferred to become PMO Hull from his Middlesbrough posting, on the move of Captain O'Sullivan to Bracknell. Captain Steel has been two years with the Met. Office, following his 24 years at sea with Bank Line, during which he provided 13 meteorological logbooks, and five years ashore in shipping administration.

Further details of the careers of the two last-named can be found in the current article on PMO operations.

CAPTAIN M.L. BECHLEY, MRIN, aged 47, is the new PMO at Greenock. Michael Bechley has been living at Lee-on-Solent, a good base from which to travel to his recent command of P&O European Ferries vessels, principally *Pride of Hampshire* on the Portsmouth to Le Havre or Cherbourg cross-Channel routes. He was educated at Brighton, Hove and Sussex Grammar School and sailed with the British India Company of the P&O Group from 1962 to 1976 before joining the ferry services. He was Chief Officer and Relieving Master (as required) from 1982 onwards, until February 1993 when his Captain's rank was confirmed. He is a dedicated marine observer, having an excellent record in the VOF, and is a member of MENSA.

MRS J. FREEMAN, Scientific Officer and Sub-Editor, the most experienced and vital member of *The Marine Observer* publications team, following her marriage in 1992, resigned in October on moving house to the West Country. Having been an important part of the Marine Division for 21 years, it was with much relief in the Office that Jan (née Mitchell) was persuaded to continue working from home, especially as no suitable replacement was forthcoming from within the Office.

CHANGE OF PORT MET. OFFICE TELEPHONE NUMBER

The telephone number for the Port Met. Office for Scotland and Northern Ireland at Greenock has been changed to 0475 724700. The office's facsimile number and address remain unchanged.

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